PSYCHOLOGY APPLIED TO PERSONNEL

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BY

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PREFACE

This volume consists of two parts. In the first is presented an important tool of the industrial psychologist: statistics. Every effort has been made to include in this discussion only those concepts which are useful industrially and of direct practical significance to personnel workers. Assignments made in this part are designed to give students actual experience in the kind of computation which is among the everyday chores of the statistician or psychometrist in the employment or personnel department.

The second part contains notes and references pertaining to *The Psychology of Personnel,* arranged under the same chapter headings as in that volume, together with questions and applications designed to test ability to apply the information contained in the text.

For use in college classes, it is recommended that assignments, questions, and applications be integrated with the topics in the text. Pages in this book may be removed and handed in for correction and grading without detracting from the value of the remaining pages for reference purposes.

HENRY BEAUMONT

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PART I: PERSONNEL STATISTICS

PART II: NOTES, REFERENCES, QUESTIONS, AND APPLICATIONS

Part I

PERSONNEL STATISTICS

INTRODUCTION

The basic data used in this part were obtained in a small plant manufacturing cutting tools for the automotive industry. The company's product was rated 100 per cent essential and was sold primarily to plants making military vehicles in the Detroit area as well as in England and Russia. The operational processes involved in turning out these cutting tools did not require a high degree of specialized skill and, except for supervisors, furnacemen, sweepers, and a few miscellaneous workers, the employees were all women. The plant was established in 1943 as a branch of a larger midwestern company in a small, non-industrial city, and recruited its workers primarily from the local population, including housewives, schoolgirls, and young married women, some of whom never had been employed before, as well as former waitresses, seamstresses, tobacco strippers, and other semi-skilled workers.

Complete personnel records, test scores, and merit ratings were available for ninety-four individuals, representing the bulk of the company's employees. Table I includes the information which will be used in subsequent sections, tabulated under the following headings:

Personnel data. In each shift, the badge number identifies individual workers grouped according to their work assignment at the time of the investigation. Shift I worked from 7 A.M. until 3 P.M., shift II from 3 P.M. until 11 P.M., and shift III from 11 P.M. until 7 A.M. Work assignments were: grinding, milling, brazing, and inspecting. The next columns list, respectively: age at nearest birthday; marital status (S-single, M-married, W-widowed, D-divorced, Sp-separated); living conditions (P-living with parents, R-renting, O-owns own home); years of schooling; length of previous employment experience and length of experience in operat-

TABLE

BASIC

Shift	Badge number	Job title	Age	Marital status	Living conditions	Education	Previous employment	Machine experience	Service	Intelligence	Total adjustment	Occupational adjustment	Dexterity	Output	Attitude	Value to Company
I	1	grinder	18	S	R	12	16	0	6	24	64	11	44	3-3	2-3	3-3
	2	"	24	S	P	9	12	0	9	2	41	7	45	2-2	1-1	3-3
	3	"	24	S	R	8	6	6	14	6	54	9	45	2-2	1-1	2-2
	4	"	19	S	P	11	9	0	13	13	47	10	41	2-2	1-2	2-2
	5	"	20	S	R	11	0	0	13	8	65	10	48	1 2	1-2	2-1
	6	"	32	M	R	11	132	0	13	13	36	2	54	2-2	1-3	2-3
	7	"	29	M	R	10	53	0	13	8	66	10	45	4-2	3-1	3-3
	8	"	23	M	R	10	36	0	13	9	48	3	44	2-2	1-1	2-2
	9	"	24	M	R	7	8	0	11	16	24	7	44	1-1	1-1	2-1
	10	"	32	M	R	8	78	0	12	9	67	1	51	2-2	1-1	2-3
	11	"	25	Sp	R	12	19	0	12	22	26	2	53	5-5	3-4	4-2
	12	"	33	Sp	R	7	130	0	2	13	28	3	39	3-3	2 2	4-3
	13	"	25	S	R	12	84	4	5	14	30	4	51	1-2	1-2	2-2
	14	"	19	S	P	11	0	0	13	25	18	2	48	1-1	1-1	1-1
	15	"	35	M	R	10	132	3	13	9	13	0	47	2-1	1-1	2-2
	16	"	34	M	R	12	2	0	8	20	51	4	52	2-1	1-1	1-2
	17	"	29	M	R	9	40	24	8	14	20	2	47	2-1	2-3	2-2
	18	"	18	S	P	11	3	0	8	14	51	4	42	1-2	1-1	2-2
	19	"	20	S	P	14	72	0	6	23	67	6	45	2-3	2-2	3-3
	20	"	21	S	P	11	45	0	11	4	41	9	52	1-1	1-3	2-2
	21	"	20	S	R	12	32	0	6	14	78	11	45	2-2	2-2	2-2
	22	"	29	Sp	R	15	14	0	12	27	24	3	50	2-1	1-1	2-1
	23	"	39	D	R	12	67	0	3	16	36	1	49	1-1	1-1	2-1
	24	"	35	M	R	12	12	2	2	13	27	1	52	2-3	1-2	2-3
	25	miller	22	D	P	11	9	0	14	15	11	2	47	3-2	3-3	3-3
	26	"	24	S	P	10	44	6	15	20	53	8	50	2-2	1-1	2-2
	27		19	S	P	14	16	0	14	24	23	4	48	2-1	1-1	2-1
	28	"	18	S	P	9	5	4	3	13	77	7	49	2-2	1-3	2-3
	29	"	19	S	P	12	0	0	13	14	35	5	42	2-1	1-1	2-2
	30	"	37	D	O	9	26	0	11	5	29	1	41	2-1	1-1	2-2
	31	"	27	W	P	9	0	0	7	15	37	3	45	3-1	2-1	3-2
	32	"	24	M	R	12	0	0	14	14	20	3	49	2-1	1-1	2-2
	33	"	21	M	R	9	2	0	12	22	66	6	47	2-1	1-1	2-1
	34	brazer	18	M	O	10	3	0	6	10	28	5	42	2-2	1-1	2-2
	35	"	31	D	P	10	0	0	14	9	26	1	51	1-1	1-1	2-2
	36	"	32	M	R	8	0	0	3	13	25	3	39	2-2	1-1	3-3
	37	"	20	S	R	12	5	0	4	17	24	4	44	2-2	2-2	3 3
	38	"	39	W	R	8	60	0	8	11	29	4	49	1-1	1-1	2-2
	39	"	18	S	P	7	8	0	2	6	23	0	46	2-2	2-2	3-2
	40	inspect.	32	W	R	14	38	0	13	19	20	8	50	1-1	1-1	2-2
	41	"	20	S	P	12	0	0	11	23	60	2	47	1-1	1-1	2-2
II	42	grinder	19	S	P	10	24	3	1	10	30	1	44	3-2	1-1	2-2
	43	"	19	S	O	10	0	0	10	12	30	2	51	2-1	1-1	2-2
	44	"	26	M	R	14	60	0	12	18	64	8	49	2-2	3-1	2-2
	45	"	22	S	P	12	51	0	10	19	37	1	47	1-1	1-1	2-2
	46	"	21	S	P	11	21	0	1	15	55	1	50	4-3	2-2	2-2
	47	"	30	M	R	12	0	0	13	18	67	10	50	2-1	2-1	2-1
	48	"	20	S	R	12	17	7	13	17	40	4	48	2-2	1-1	2-2

I

DATA

Shift	Badge number	Job title	Age	Marital status	Living conditions	Education	Previous employment	Machine experience	Service	Intelligence	Total adjustment	Occupational adjustment	Dexterity	Output	Attitude	Value to Company
II	49	grinder	23	S	P	12	60	0	10	25	30	4	47	2-2	I-I	2-2
	50	"	18	S	P	12	0	0	1	17	37	2	49	3-3	2-2	2-2
	51	"	31	M	R	12	0	0	10	20	37	5	50	2-2	2-1	2-2
	52	"	28	M	R	4	6	0	4	18	46	2	53	2-2	2-1	2-2
	53	"	30	M	R	12	0	0	9	20	49	2	47	2-2	I-I	2-2
	54	"	19	S	P	10	0	0	3	14	36	3	52	2-2	I-I	2-2
	55	"	23	Sp	R	9	5	0	10	20	26	6	50	3-2	2 3	2-3
	56	"	21	S	P	8	6	0	1	12	26	0	46	3-3	1-3	2-2
	57	miller	26	M	R	8	0	0	13	16	46	6	46	1-2	2-1	2-2
	58	"	34	M	R	10	16	0	1	17	15	0	38	3-3	2-2	3-3
	59	"	24	Sp	P	8	9	0	9	8	60	5	46	1-2	2-1	2-2
	60	"	33	W	O	8	23	0	4	4	56	4	48	2-2	2-2	2-3
	61	"	27	S	R	8	56	0	4	10	27	2	47	2-2	1-2	2-2
	62	"	19	S	P	10	20	0	3	20	64	2	41	3-3	2 2	3-3
	63	"	20	M	R	10	6	0	1	12	38	7	46	2-3	I-I	3-3
	64	brazer	23	M	R	8	0	0	2	6	34	5	51	2-2	2-2	2-2
	65	"	18	S	R	12	10	0	2	13	32	1	47	2-2	2-2	3-3
	66	"	34	M	R	7	48	24	1	11	23	4	45	3-3	2-2	2-2
	67	inspect.	18	S	R	12	0	0	11	10	32	6	44	3-3	2-2	2-3
	68	"	22	S	R	12	12	0	6	15	38	1	48	2-2	I-I	2-2
III	69	grinder	18	S	P	10	6	6	2	26	39	4	42	2-3	1-2	3-3
	70	"	29	M	R	10	24	0	11	16	56	2	39	2-2	3-3	3-3
	71	"	20	S	P	12	8	0	11	12	46	5	48	3-2	2-2	3-2
	72	"	34	D	P	11	41	0	12	15	29	11	37	3-2	3-2	4-2
	73	"	18	M	R	10	0	0	1	14	36	4	49	3-3	3-3	4-4
	74	"	18	S	P	11	5	0	8	19	64	3	51	2-1	1-1	2-2
	75	"	26	M	R	9	14	0	9	14	68	8	44	2-2	2-2	3-3
	76	"	20	S	P	12	19	0	1	26	54	8	50	2-2	1-1	3-2
	77	"	18	Sp	P	9	0	0	11	10	33	2	42	2-2	1-1	2-2
	78	"	23	S	P	7	15	0	9	16	76	11	42	2-2	4-3	2-3
	79	"	19	S	P	11	0	0	1	13	32	6	42	3-2	2-2	3-3
	80	"	18	S	P	9	0	0	1	10	26	4	48	4-3	3-2	4-3
	81	miller	31	D	P	12	21	0	11	7	44	0	49	3-2	2-2	2-2
	82	"	30	M	O	12	25	0	2	14	39	6	45	2-1	2-2	2-2
	83	"	18	S	P	10	9	0	1	21	20	6	48	3-3	3-3	4-4
	84	"	20	M	R	8	36	0	2	3	25	4	44	2-2	1-1	2-2
	85	"	18	S	P	10	6	0	2	14	24	4	40	2-2	1-2	2-2
	86	"	18	S	P	9	4	0	2	9	49	5	48	3-4	2-2	4-4
	87	"	34	M	P	10	16	0	2	24	22	7	44	2-2	1-1	2-2
	88	"	29	M	R	8	120	0	10	15	23	0	50	2-2	1-1	2-2
	89	brazer	18	S	P	11	7	0	8	19	18	2	38	2-2	3-3	3-3
	90	"	25	M	R	9	0	0	2	6	23	2	56	3-4	1-1	4-4
	91	"	18	S	P	12	2	2	2	13	67	8	31	3-3	3-3	4-4
	92	inspect.	20	M	R	7	4	0	10	15	47	4	42	2-2	2-2	2-2
	93	"	18	S	P	9	6	0	8	20	30	2	45	2-2	3-3	2-2
	94	"	19	M	R	10	1	1	9	11	68	10	52	2-2	2-2	2-2

ing a machine prior to employment by the company, each expressed in number of months; and length of service with the present company in nearest number of months. All these data were obtained from the personnel files.

Test data. Three sets of scores are included in this table:

(1) Scores on the Wonderlic Personnel Test, an adaptation of the Otis Self-administering Intelligence Test which contains items predicting industrial success most satisfactorily. This test has a range of 50 points and a time limit of twelve minutes.

(2) Scores on the Bell Adjustment Inventory, Adult Form, a test designed to measure the level and type of personality adjustment, including 160 items which are scored to give six separate results: a total adjustment score and sub-scores for each of the following types of adjustment: home, health, social, emotional, and occupational. The table includes only the total and occupational adjustment scores. These scores represent the number of unfavorable answers to the questions in the Inventory, so that lower scores indicate a higher level of adjustment than do higher scores.

(3) Scores on the Purdue Pegboard. This is the total of three separate scores: left hand only, right hand only, and left and right hands combined, each placing pegs into a vertical row of holes within a time limit of thirty seconds.

Merit ratings. Each worker was rated by two judges: the shift superintendent and the foreman of her own department. The first of the two ratings in the table is that given by the superintendent, the second is the foreman's estimate of the girl's job performance. Three ratings are included: output, attitude, and general value to the company, each of which was rated on a five-point scale. The highest gradation was given a value of one point and the lowest five points, so that lower point values indicate higher ratings.

Throughout the following pages, reference will be made to these data to illustrate basic statistical techniques.

SECTION I

GROUP CHARACTERISTICS

There is no way in which management can obtain a comprehensive view of the company's employees from such a table as is presented in the Introduction. These data are too confusing to permit an adequate understanding of what kind of people they are, to what extent they are alike, and in what respects they differ. The first step toward reaching such an understanding is to organize the data systematically. Assuming that we wish to determine how old these workers are, we shall place their respective ages in a new table.

Frequency distribution. This is a simple classification of data into groups of equal size for the purpose of obtaining an orderly presentation. These groups are known as *class intervals* (c.i.), and may be selected to include any desired range. However, experience shows that a table containing from 10 to 15 intervals is most satisfactory for statistical purposes. Because each c.i. must include an equal range of data, the simplest method for determining that range is to divide the difference between the highest and lowest scores in the distribution by the number of desired intervals. In our table, the oldest employee is 39 and the youngest is 18, which gives a total range of 21 years. Eleven intervals of 2 years each would include all the cases. Thus we arrive at the following frequency distribution (Table II).

It should be noted that this table is constructed and filled out according to certain general rules:

1. The class intervals are listed from the bottom of the table to the top, ranging from low to high in the same order.

2. The lower limit of each class interval is a multiple of the width of the interval. This means that, even if the youngest worker in this plant had been 19 years old instead of 18, the lowest c.i. would have been the same as it is now,

TABLE II

AGE DISTRIBUTION

Age	Tally	Frequency
38-39	//	2
36-37	/	1
34-35	𝍸 //	7
32-33	𝍸 /	6
30-31	𝍸 /	6
28-29	𝍸 /	6
26-27	𝍸	5
24-25	𝍸 ////	9
22-23	𝍸 ///	8
20-21	𝍸 𝍸 𝍸	15
18-19	𝍸 𝍸 𝍸 𝍸 𝍸 ////	29
		N = 94

namely 18-19, if the width of the interval were two years.

3. Going down the list of ages in Table I, the tabulator makes a vertical mark in the second column of the frequency distribution as he enters each case opposite the appropriate c.i. To simplify counting, he crosses out each series of four items when the fifth entry is made.

4. In the frequency column, the number of cases is listed in arabic numerals after the tabulation has been completed. This is known as the f-column.

5. To check whether any data have been overlooked, the entries in the f-column are added. This results in the figure 94, which is the value of N (number of cases).

Already, our information has become better organized than was the case in Table I. But there is as yet no comprehensive picture of the group such as would result from expressing their ages in terms of single figures. In the following sections are discussed methods of computing single values to show how much the members of a group resemble each other in a given characteristic, and how far they differ from each other. A combination of these two values contains in a condensed and comprehensible form all the information in Table I and in the frequency distribution.

Name . . . . . .

ASSIGNMENT I

Make a frequency distribution of the intelligence scores obtained by the members of this group. Note that the lowest score on the Wonderlic Test is 2 and the highest score is 27.

DISTRIBUTION OF INTELLIGENCE SCORES

Wonderlic Score	Tally	Frequency
		N =

Section II

MEASURES OF CENTRAL TENDENCY

A value which is representative of the entire group, because it is the point around which the data tend to group themselves, is known as a measure of central tendency. There are three such measures in use.

The Mean. This measure is more familiarly, but less accurately, known as the average, and for a small number of cases is computed simply by adding the values in the distribution and dividing this sum by the number of cases. For instance, the average age of the two inspectors on the first shift is

$$\frac{32 + 20}{2} = 26$$

However, this method is cumbersome when longer series of data are involved, and it is simpler to compute the mean from the frequency distribution. This method is based on the assumption that each score as tabulated in this distribution has the same value as the midpoint of the c.i. in which it falls. This is obviously not correct, and for this reason the mean so found is an approximation rather than the exact mean. The larger the number of cases, the smaller this error tends to be, and the method is so much simpler than that of adding together individual scores that it is used generally to find the value of the mean.

In order to further facilitate the computation of the mean from the frequency distribution, it is assumed that its value must lie close to the center of the distribution. Starting from this arbitrary point, the actual mean is then computed in terms of c.i. units away from the assumed mean.

This requires the addition of two more columns to our dis-

tribution table. The first of these is the d (deviation) column and lists the number of c.i. units each c.i. is located above or below the arbitrarily chosen mean; the second computes the total value of the scores in the f-column in terms of their deviation from the assumed mean as indicated in the d-column, and is called the fd-column. The data for this column are found by multiplying the d-values by the frequency of the cases in each c.i. The result of these tabulations is shown in Table III.

TABLE III

THE MEAN AGE

Age	f	d	fd
38-39	2	5	10
36-37	1	4	4
34-35	7	3	21
32-33	6	2	12
30-31	6	1	6
28-29	6	0	0
26-27	5	−1	−5
24-25	9	−2	−18
22-23	8	−3	−24
20-21	15	−4	−60
18-19	29	−5	−115
	N = 94		Σ fd = −199

The arbitrary mean was selected in the middle of the frequency distribution, which in this case turned out to be much too high as evidenced by the negative value obtained for the sum of the fd-column (Σfd). It makes no difference where this starting point is chosen in computing the mean, because the answer is the same in any case.

The mean is found by entering the obtained values into the formula

$$M = M^{\circ} + \text{c.i.} \quad \frac{\Sigma fd}{N}$$

in which M° is the midpoint of the c.i. in which the as-

sumed mean falls. The computation now proceeds as follows:

$$M = 28.5 + 2\ \frac{-199}{94} = 28.5 - 4.23 = 24.27$$

Had we chosen the c.i. 24-25 as the one in which the arbitrary mean occurs, the calculation would have been:

$$M = 24.5 + 2\ \frac{-11}{94} = 24.27$$

Or, if we prefer to have the zero-point in the lowest c.i., the corresponding calculation would be:

$$M = 18.5 + 2\ \frac{271}{94} = 24.27$$

The advantage in selecting a point near the center of the distribution is that the multiplication of the f- and d-columns and the addition of the fd-column are simplified.

The Median. The median is that point in a distribution, arranged in order from the highest to the lowest value, on either side of which lies an equal number of values. For a small number of cases, therefore, the simplest way of computing the median is to count from the top value down to the middle of the distribution or from the bottom value up to that point. If there is an equal number of cases, that point will fall midway between the last value in the lower half and the first value in the upper half if we count from the bottom up. If there is an uneven number, the median will coincide with the value of the case which is right in the middle. The median age of the six brazers on the first shift falls midway between 20, which is the value of the third case from the bottom, and 31, the value of the third case from the top, and thus is 25.5. For the second-shift brazers this value is 23, because that is the age of the girl who is right in the middle of the distribution.

When there is a large number of cases, counting halfway up or down is a cumbersome method, and so we refer again to our frequency distribution. This time, however, there is no need to assume an arbitrary median because we know that for our series of 94 cases that value must fall in c.i. 22-23,

because that is where the middle of the distribution is. But its value lies somewhere between the upper and lower limits of this c.i. and we must determine just where that is. Now there are 44 cases in the c.i.'s below the one in which the median falls and 42 in the c.i.'s above it, so that the median will be found at a point 3 cases above the lower limit and 5 cases below the upper limit of c.i. 22-23. That means that we should count 3 cases above the lower or 5 cases below the upper limit on the assumption that all 8 cases in that c.i. are evenly distributed over the two-year period included in it, and that the value of each of these 8 steps within the interval is 2 (the width of the interval) divided by 8 (the number of cases), or ¼. That, of course, is an approximation, and the median found by this method is inaccurate to the extent that the cases in this c.i. are not spread evenly from its lower to its upper limit.

The lower limit of this c.i. actually is 21.5, because the data in this particular distribution are ages to nearest birthday, so that a worker who is only a day older than 21.5 years will be counted in this c.i. When the values refer to test scores or other data which are discrete to the extent that their value is either 21 or 22 without any possible gradation in between, the lower limit of the c.i. is not halfway between this and the preceding interval, as is the case in our example. If the values in our distribution were scores on a test, the lower limit of c.i. 22-23 would be 22 and the upper limit 23, because only scores of 22 and 23 would be included in this interval and no scores between 21 and 22 or between 23 and 24 can occur.

Therefore, to get the value of a point 3 cases above the lower limit of interval 22-23, our computation is

$$21.5 + 3 \times \tfrac{1}{4} = 22.25$$

To check the accuracy of our figures, we may start from the top and calculate the median by finding the value of the point 5 cases below the upper limit of c.i. 22-23, which is

$$23.5 - 5 \times \tfrac{1}{4} = 22.25$$

Name

ASSIGNMENT II

Compute the mean adjustment score by the frequency distribution method.

Bell Score	Tally	f	d	fd
		N =		Σfd =

$$M = M^{\circ} + \text{c.i.} \frac{\Sigma fd}{N}$$

Substitute the values found above:

M = + ×— =

Name. . . . . .

Assignment III

Find the median occupational adjustment score by the frequency distribution method. But note that the range of scores is from 0 to 11, so that the width of each class interval should be 1 point.

MEDIAN ADJUSTMENT SCORE

Score	Tally	f
		N =

Insert the proper values by counting up from the bottom of the table.

Md = + × =

Check the accuracy of your computation by counting down from the top.

Md = − × =

The Mode. The least frequently used measure of central tendency is the mode, which is the value occurring with the greatest frequency. This is, in most cases, a relatively meaningless measure except as it may be desired to discover what value is found most often, but this is not necessarily typical of the entire group. In our data, an age of 18 is found more often than any other, and at the same time this represents the youngest workers in the group. It is, therefore, in no sense representative and means little or nothing as a measure of central tendency. If, on the other hand, this distribution had been a more normal one in which few cases occurred at the lowest and highest ends and most cases congregated in the middle, the mode would have been a more adequate measure of the group characteristic.

There is an interesting statistical problem in a distribution in which each value occurs with equal frequency. For instance, if there had been three girls in our group who were 18, three who were 19, and so on up through age 39, the question would be whether this distribution would have no mode at all or as many modes as there are separate values. This question, of course, is purely academic, but it emphasizes the fact that a distribution may have more than one mode. Instead of having nineteen women who were 18 years old and ten who were 19, there might have been fifteen of each age, in which case the distribution would have contained two modes.

These three measures of central tendency give an answer to the question as to how similar are the members of the group by expressing in a single figure the point around which they tend to group themselves. In some distributions, there are fewer and fewer cases as we get away from the center, so that the median (the point on either side of which is found an equal number of cases) and the mode (the value occurring with the greatest frequency) coincide. In such a case, the mean ("average" value) usually falls at the same point as the other two measures. Such are known as *normal* distributions, although they are seldom encountered unless the group is very large and unselected. In other cases, the

distribution tends to gravitate in one direction or the other away from the center. If the ages of all men, women, and children in a population of several million people were entered in a frequency distribution, it is likely that a fairly normal distribution would be found in that toward the upper and lower extremes fewer and fewer cases would occur. But if the ages of inmates of a home for the aged or the enrollees in a kindergarten were listed, it is obvious that a very different situation would prevail. So it should not surprise us to find that the median, mean, and mode for our present group do not coincide. The median and mode are lower values than the mean, because there are more cases below the mean than there are above it.

This raises the point as to which is the better measure of central tendency in this case, the mean or the median. We already have eliminated the mode because it does not give us information that would help us understand better the characteristics of our group other than to indicate that there are more 18-year olds than members of any other age group. The answer to this question may be given as follows. Let us assume that the oldest person in the plant had not been 39 years old but 59 or even 69, or any other value completely out of line with the rest of the group. Such a value, of course, would in no way affect the median, because the number of cases remains the same, but the mean would be decidedly altered if such an unusual case should be included in the group. The median, therefore, is a more stable measure because it is not influenced by extreme cases at either end of the distribution and changes only when the number of cases is changed. Whenever there are more cases at one extreme than at the other, as is true in our distribution where the mode is at the very bottom, the median gives a more accurate picture of the total group than does the mean.

SECTION III

MEASURES OF VARIABILITY

Now that we have calculated the point around which the members of a group tend to arrange themselves with respect to a given characteristic, we should inquire into the extent to which they tend to differ among themselves. This is important because it enables us better to judge the characteristics of the distribution. When we know that the median age is 22.25 and the mean 24.27, we still do not know much about the group as a whole, because the same median would prevail if the youngest girl were 21 instead of 18 and the oldest employee 27 or 73 instead of 39, provided the number of cases were not altered; and the same mean could be found even if the cases were distributed differently. We need, therefore, a measure to indicate the amount of spread among the values so that we may see at a glance how large are individual age differences among the members of the work force.

The Range. The simplest measure of variability is the range, found by subtracting the lowest from the highest value. In our distribution, the range is

$$39 - 18 = 21$$

But this value still is only a gross measure of variability, because it does not indicate the proximity of individual measures to the point of central tendency, so that conceivably the ages might congregate around 38 and 19 instead of being distributed over the entire scale as they actually are.

The Standard Deviation. A much more dependable measure is the standard deviation (S.D.) which is computed from the frequency distribution. It expresses in a single figure the average extent to which all cases in the group differ either positively or negatively from the measure of central tendency.

It is found by adding one more column to the table used for finding the mean (Table III) in which the fd-column is multiplied by the d-column. This operation is shown in Table IV.

TABLE IV

STANDARD DEVIATION

Age	f	d	fd	fd^2
38-39	2	5	10	50
36-37	1	4	4	16
34-35	7	3	21	63
32-33	6	2	12	24
30-31	6	1	6	6
28-29	6	0	0	0
26-27	5	−1	−5	5
24-25	9	−2	−18	36
22-23	8	−3	−24	72
20-21	15	−4	−60	240
18-19	29	−5	−145	725
	N = 94		$\Sigma fd = -199$	$\Sigma fd^2 = 1237$

The formula for the S.D. is

$$\text{S.D.} = \text{c.i.} \sqrt{\frac{\Sigma fd^2}{N} - \left(\frac{\Sigma fd}{N}\right)^2}$$

so that our computation reads:

$$\text{S.D.} = 2 \sqrt{\frac{1237}{94} - \frac{-199}{94}}$$

$$= 2 \sqrt{13.16 - 4.49} = 2\sqrt{8.67}$$

$$= 2 \times 2.94 = 5.88$$

We now have an important measure with which to judge the characteristics of our distribution: the ages of all the women in the group differ, on the average, 5.88 years from the mean value of 24.27. This includes, of course, the 18-year old whose age is 3 c.i.'s below the mean age, as well as the 39-year old who age is 7 c.i.'s above that value. The larger the S.D., the greater the variability of the group and the less its members resemble each other in the measured trait.

Name . . . . . .

Assignment IV

Compute the mean, median, and standard deviation of the intelligence scores, using the frequency distribution in Assignment I.

Wonderlic Score	f	d	fd	fd^2
	N =		Σfd =	Σfd^2 =

$$M = M^{\circ} + \text{c.i.}\ \frac{\Sigma fd}{N} = \quad + \quad \times \frac{\quad}{\quad} =$$

$$Md = \quad + \quad \times \quad =$$

$$\text{or} = \quad - \quad \times \quad =$$

$$\text{S.D.} = \text{c.i.}\ \sqrt{\frac{\Sigma fd^2}{N} - \left(\frac{\Sigma fd}{N}\right)^2} = \sqrt{\frac{\quad}{\quad} - \left(\frac{\quad}{\quad}\right)^2}$$

$$= \sqrt{\quad - \quad} = \quad \times \quad =$$

Section IV

GROUP COMPARISONS

The measures which we have computed thus far have enabled us to compare different groups in our distribution in respect to their individual central tendencies and variabilities. For instance, the question now can be answered as to which of these shifts has the highest average age, or on which of these the members of the work force tend to differ most in this respect. The answers are found in Table V.

Table V

AGE CHARACTERISTICS

	Shift I	Shift II	Shift III	All Shifts
Mean age	25.57	24.06	22.42	24.27
Median age	23.93	22.50	19.50	22.25
Standard Dev.	6.34	5.20	5.34	5.88
Age range	21	16	16	21

It appears that the average age of the members of the first shift is higher than that of the others, and hence higher than the average age for the entire personnel of the plant. At the same time, there are wider age differences on the first shift than on any of the others. On the second shift, the girls are more nearly of the same age than on the other two. This fact cannot be concluded from the ranges of ages in each shift, which are 21, 16, and 16, respectively, with 18 being the lowest age in each case. From this one might assume that the variability of the second and third shifts is the same, but the S.D. shows that, even though these two groups do not differ in the range of ages included in them, the distribu-

Name

Assignment V

Make a table similar to Table V to answer the questions: on which of the three shifts are the employees most nearly alike in intelligence and on which shift is their average level of intelligence highest?

INTELLIGENCE SCORES *

	Shift I	Shift II	Shift III	Entire plant †
Mean				
Median				
S.D.				
Range				

* Obtain data from the table on the back of this page

† Obtain data for this column from Assignment IV.

tion of ages within shifts is not the same and that the members of the second are more nearly of the same age than are those of the third.

Name

Assignment V

Make a table similar to Table V to answer the questions: on which of the three shifts are the employees most nearly alike in intelligence and on which shift is their average level of intelligence highest?

INTELLIGENCE SCORES *

	Shift I	Shift II	Shift III	Entire plant †
Mean				
Median				
S.D.				
Range				

* Obtain data from the table on the back of this page.
† Obtain data for this column from Assignment IV.

Scores	Shift I					Shift II					Shift III				
	Tally	f	d	fd	fd^2	Tally	f	d	fd	fd^2	Tally	f	d	fd	fd^2
		$N=$	$\Sigma fd=$		$\Sigma fd^2=$		$N=$	$\Sigma fd=$		$\Sigma fd^2=$		$N=$	$\Sigma fd=$		$\Sigma fd^2=$
	$M=$ + × ——— =					$M=$ + × ——— =					$M=$ + × ——— =				
	$Md=$ + × =					$Md=$ + × =					$Md=$ + × =				
	$S.D.=$ $\sqrt{\text{———} - (\text{———})^2}=$					$S.D.=$ $\sqrt{\text{———} - (\text{———})^2}=$					$S.D.=$ $\sqrt{\text{———} - (\text{———})^2}=$				

Section V

DETERMINING THE SIGNIFICANCE OF TRAITS

The practical significance of differences in traits lies in the fact that the characteristics of workers may give us important clues to their industrial usefulness. In the selection process and in the proper placement of employees, a measure of their significant characteristics may determine whether they are likely to be suitable for a given type of work. This prediction can be made on the basis of what has been found to be true of the present group of workers. Here are some examples of different kinds of individual trait differences.

Dexterity. If it should be the case that the best workers are distinguished from the poorest by having a greater degree of manipulative dexterity as well as by their output, then a measure of their dexterity will give us information on the likelihood of applicants becoming successful workers.

In order to obtain such a measure, we may compare dexterity scores of the employees whose output was considered superior with the scores of those rated lowest in this respect. The first group contains all those who were rated in first place by either one of both judges, and the latter all those who were placed in the third, fourth, and fifth gradations (Table VI).

Table VI

DEXTERITY SCORES OF HIGH AND LOW PRODUCERS

	Rated high	Rated low
Number of cases	26	27
Range of scores	41-52	31-56
Mean Purdue score	48.23	45.59
Median Purdue score	48.0	46.0

This table indicates that the mean and median dexterity scores of the best producers are higher than those of the low producers, and that there is more variability in the lower group. When it is considered that there were some among the poor producers who obtained higher dexterity scores than some of the good producers, it is obvious that a high score is not indicative of the ability to be rated high on production. However, the range of scores for the poor workers extends a full ten points lower than that for workers rated superior producers, so that a low score does appear to be indicative of poor performance as rated by the supervisors. This certainly is the case with scores between 31 and 41, which were obtained only by low producers. The relationship between dexterity scores and job performance could be determined by means of the coefficient of correlation if exact measures of individual output were available. For the moment, we note that there is a tendency for employees whose output is rated low to attain lower scores than those who are rated high in output on the Purdue Pegboard which is a measure of manual dexterity.

Intelligence. It would be interesting to know whether employees who are rated high in value to the company can be distinguished from others by such an index as their intelligence scores. Using the same technique of separating those who were rated at the top from those rated in the third and lower gradations by at least one of two judges, we obtain the data contained in Table VII.

TABLE VII

INTELLIGENCE SCORES OF MOST AND LEAST VALUABLE WORKERS

	Rated high	Rated low
Number of cases	9	37
Range of scores	8-27	2-26
Mean score	19.56	14.38
Median score	19.0	14.0

It is evident that the average intelligence of the most valuable workers, as measured by the Wonderlic Personnel Test, is considerably higher than that of the least valuable employees. There is a 5-point difference between the mean and median scores of the two groups, and the range for the inferior group extends 6 points below that for the better workers. Apparently, those most valuable to the company tend to be higher in intelligence than those least valuable.

Stability. The question might well be asked: Does the company tend to retain its better employees, or do they move on to other types of employment, leaving behind the less desirable workers? To answer this, we may compute the average measures listed in Table I according to whether the workers have been with the company nine months or longer (46 cases), or less than that period (48 cases). The latter group represents an unselected sample, because it is as yet unknown whether its members will eventually belong to the "veteran employee" group. If complete data were available on all those who quit after entering the company's service at the same time with the girls who now have served nine months or more, the comparison would, of course, be much more significant. The present figures, presented in Table VIII, mean anything only if we may assume that the average quality of employees has not changed.

TABLE VIII

CHARACTERISTICS OF OLDER AND NEWER EMPLOYEES

Characteristic	Nine months' service	Less than nine months
Months with Company	11.65	3.27
Average age	24.91	25.56
Years of schooling	10.54	9.88
Months of previous empl.	24.54	19.33
Months of machine exper.	.50	1.44
Intelligence score	14.57	14.48
Total adjustment score	41.76	37.90
Occupational adj. score	4.93	3.81
Dexterity score	41.76	37.90

The group of employees having longer service averaged almost one year's employment with the company, and the others slightly over three months. The former tend to be slightly younger than the latter, have slightly more schooling, and more than 5 months more previous employment experience. They have, however, less machine experience. This probably indicates the importance of a longer occupational history, regardless of its nature, as a factor in labor stability. There is very little difference in the intelligence of the two groups, but it should be noted that the group with longer service is less adjusted in general and has a lower occupational adjustment level than the more recently hired girls. In dexterity scores, there is a tendency for older workers to obtain higher scores.

The statistical devices discussed in this section serve to determine the significance of individual differences in the traits of employees, not only as an aid in understanding them better, but also as a guide in selecting from among applicants such new workers as possess the characteristics of satisfactory workers.

Name . . . . . .

ASSIGNMENT VI

In the tables below, find the answer to the following questions:

(1) Are the workers who are rated highest in value to the company older or younger than those rated lowest?

(2) Do employees rated lowest in attitude have less previous employment experience than those rated highest in this respect?

AGES OF LEAST AND MOST VALUABLE WORKERS

Characteristic	Rated high	Rated low
Number of cases		
Age range		
Mean age		
Median age		

PREVIOUS EMPLOYMENT EXPERIENCE OF WORKERS RATED HIGH OR LOW IN ATTITUDE

Characteristic	Rated high	Rated low
Number of cases		
Experience range		
Mean length of exper.		
Median length of exp.		

What is the answer to these questions:

(3) Do employees with higher seniority rent their homes more often than those with lower seniority?

(4) Do single employees tend to be more intelligent than married workers?

LIVING CONDITIONS

Characteristic	More than 9 months with this Company	Less than 9 months with this Company
Number of cases		
Number renting		
Percentage		

INTELLIGENCE AND MARITAL STATUS

Characteristic	Married	Single
Number of cases		
Intelligence range		
Mean intell. score		
Median intell. score		

Section VI

COMPARING INDIVIDUALS

The foregoing computations are designed to measure group characteristics, but of equal importance are techniques that give us a more accurate picture of an individual worker in relation to the characteristics of other workers. When the time comes to determine the most desirable candidate for upgrading, several employees may have to be compared with each other on the basis of a variety of traits. The traits to be taken into consideration are those which, in the company's experience, are related to success on the next job, and are to be determined by the correlation method. A similar situation exists when workers are to be transferred from their regular work to operations involving different skills or capacities. In that case, selection is best made by measuring the extent to which available workers possess the qualifications for the new job and comparing them on that basis. Finally, during slack periods it may become necessary to lay off part of the personnel of a department or an entire plant. Even though this usually is done in reverse order of seniority, most union contracts provide that ability shall be taken into consideration as well. When the essential characteristics of a satisfactory operator have been determined, layoffs may be made more intelligently by comparing workers with low seniority rights on the extent to which they possess these traits and determining the order in which they will be discharged by the degree to which they fail to meet the job requirements.

Assuming that a company finds that its best supervisors are more mature, have more schooling and longer previous employment experience than the poorer supervisors, the problem arises as to the relative merits of two operators in

line for promotion when A is older than B but has not gone as far in school and has slightly less employment experience. Does the advantage of maturity compensate for the two disadvantages? Or does B's background make her the more desirable candidate, even though she trails behind A in maturity?

These questions can be answered only after we have reduced these characteristics to comparable values and have weighted these in accordance with the relative importance of the three traits as determined by their individual correlations with our criterion of success in supervisory work.

Comparable values. To obtain values which can be directly compared with each other, regardless of the nature of the data from which they were obtained, it is necessary to express each individual characteristic in terms of its distance from the average extent to which this trait is possessed by the group from which selection is to be made, and in relation to the variability of that group in this particular respect. The computation of comparable values, generally known as Z-scores, involves finding the mean value and standard deviation of the values obtained on each characteristic. The formula is

$$\text{Z-score} = \frac{\text{raw value} - \text{mean value}}{\text{S.D.}}$$

Assuming that our tool plant wishes to select a forelady from among its grinder operators, we should first determine the Z-scores of all candidates on the important traits which make for success in supervisory work. Let us further assume that the following correlations have been found with the degree of success attained by present supervisors: age, .21; education, .25; and previous employment experience, .31, so that the relative importance of these three characteristics is, respectively, 1, 1.2, and 1.5. These data suffice to make our selection on the basis of comparable Z-scores from among grinders who have been with the company nine months or more. Table IX lists the age, educational background, and previous employment experience of each of the twenty-nine candidates selected from among the grinders in Table I on

the basis of their seniority with this company. Beside these data are the Z-scores for these same characteristics.

TABLE IX

GRINDERS AVAILABLE FOR PROMOTION

Badge Number	Age	Years Educ.	Months Exper.	Z-scores		
				Age	Educ.	Exper.
2	24	9	12	— .24	— .86	— .75
3	24	8	6	— .24	— 1.40	— .92
4	19	11	9	— 1.25	.22	— .83
5	20	11	0	— 1.05	.22	— 1.09
6	32	11	132	1.38	.22	2.59
7	29	10	53	.77	— .32	.39
8	23	10	36	— .44	— .32	— .08
9	24	7	8	— .24	— 1.94	— .86
10	32	8	78	1.38	— 1.40	1.09
11	25	12	19	— .04	.76	— .56
14	19	11	0	— 1.25	.22	— 1.09
15	35	10	132	1.97	— .32	2.59
20	21	11	45	— .85	.22	.17
22	29	15	11	.77	2.38	— .69
43	19	10	0	— 1.25	— .32	— 1.09
44	26	14	60	.15	1.84	.59
45	22	12	51	— .64	.76	.33
47	30	12	0	.98	.76	— 1.09
48	20	12	17	— 1.05	.76	— .61
49	23	12	60	— .14	.76	.59
51	31	12	0	1.18	.76	— 1.09
53	30	12	0	.98	.76	— 1.09
55	23	9	5	— .44	— .86	— .95
70	29	10	24	.77	— .32	— .42
71	20	12	8	— 1.05	.76	— .86
72	34	11	41	1.79	.22	.06
75	26	9	14	.15	— .86	— .69
77	18	9	0	— 1.45	— .86	— 1.09
78	23	7	15	— .44	— 1.94	— .62

The Z-scores in the above table were computed by substituting in the formula the values found for the means and the standard deviations of the three traits here considered.

Using the techniques discussed in previous paragraphs, these were found to be as shown in Table X. The computation of the Z-score for age of grinder #2 would be thus:

$$\text{Z-score} = \frac{24 - 25.18}{4.94} = -.24$$

This same process is repeated for each of the other values in the distribution and results in the Z-scores given in Table IX.

TABLE X

MEAN VALUES AND S.D.

Characteristic	Mean	S.D.
Age	25.18	4.94
Education	10.59	1.85
Employment Exper.	38.98	35.84

The variations of the twenty-nine candidates on the three characteristics held essential to good supervision now have been reduced to a common denominator, and we may proceed to weight the traits according to their respective significance determined by their correlation with criteria of success in supervisory work. After this has been done, a combined Z-score is obtained by adding the weighted individual scores for each person.

Previous employment experience has been found to be most significant in determining chances of supervisory success, so that the girls who stand out most in this respect will have a much better chance of receiving this promotion. The two grinders #6 and #15 have the same amount of such experience, and on this score, both would appear equally desirable. However, one is three years older than the other, but has one year less school training to her credit. The technique of weighted Z-scores makes it possible to determine the extent to which these variations balance each other. Table XI lists the weighted scores and combined weighted Z-scores.

It appears that these two candidates are so nearly alike in the three characteristics considered that there is no way of

distinguishing between them on this basis. If education had been found twice as significant in relation to supervisory success, the respective combined weighted Z-scores would have been 5.78 and 5.09 and thus tipped the scales in favor of candidate #6. Whether or not one candidate stands out above others when the aggregate of several traits is considered can be determined only by the technique here under discussion. When this procedure results in a tie, as is the case in our example, other factors must be taken into consideration, such as personality, adjustment, or marital status, in order to make a final decision.

TABLE XI

COMPARISON OF TWO CANDIDATES ON BASIS OF COMBINED WEIGHTED Z-SCORE

Badge Number	Weighted Z-scores			
	Age (Z-score × 1)	Education (Z-score × 1.2)	Employment (Z-score × 1.5)	Combined Z-score
6	1.38	.26	3.88	5.52
15	1.97	— .38	3.88	5.47

There are numerous industrial uses for the Z-score method of comparing individual employees on a variety of characteristics. In addition to candidates for promotion, we may select by this method those to be transferred to other departments and persons to be laid off during times when the staff must be reduced. The method is especially useful in computing combined test scores and combined merit ratings.

Name. .....

Assignment VII

Assume that the grinding department enters a slack period and decides to lay off four girls. They are to be selected on the basis of (1) age, (2) previous experience, and (3) seniority, and will be laid off in reverse order of their records in this respect. Seniority counts 3 times as much as age, and previous employment experience 1.5 times as much.

Z-SCORES

Badge Number	Age	Employment Experience	Seniority	Weighted Scores			
				Age	Empl. Exp.	Sen.	Combined

The four girls should be laid off in this order:

Order	Badge #	Combined Z-score
first		
second		
third		
fourth		

SECTION VII

DETERMINING TRAIT RELATIONSHIPS

We observed in the section "Determining the Significance of Traits" that there is an apparent relationship between certain traits possessed by the workers as a group and as individuals. A method was suggested there for determining the significance of this relationship by comparing the best workers with the poorest group, leaving out of consideration the middle or average group. At this time we shall consider a more general method of answering the question concerning the degree of relationship which exists between different characteristics by taking into consideration all the available data.

Correlation. This is known as the correlation method and results in a single coefficient which expresses the degree of relationship between two sets of data obtained on the same group of individuals. The principal advantage of this coefficient is not that it states this relationship in its simplest possible form, important though it may be to reduce this to a single figure; but rather that it enables us to make certain predictions concerning the existence or development of one characteristic when we know the extent to which the related trait is present. The procedure for obtaining this coefficient is relatively simple provided the steps necessary in its computation are followed carefully and in the proper order.

If we wish to determine to what extent the age of our workers is related to their intelligence, we may enter these data from Table I on the correlation chart in the following manner:

1. The ages of all workers are arranged into suitable intervals and the limits of these c.i.'s are written along either the

top of the correlation chart (the X-axis) or on the left-hand side (the Y-axis).

2. Their intelligence test scores are divided into suitable class intervals whose limits are written along the other axis.

INTELLIGENCE / AGE	0-2	3-5	6-8	9-11	12-14	15-17	18-20	21-23	24-26	27-29		f_y	d_y	$f_y d_y$	$f_y d_y^2$
38-39				/		/						2	7	14	98
36-37		/										1	6	6	36
34-35				//	/	//	/		/			7	5	35	175
32-33		/		/	///		/					6	4	24	96
30-31			/	/	/		///					6	3	18	54
28-29			/		/	//	/			/		6	2	12	24
26-27				/	/	//	/					5	1	5	5
24-25	/		///		//	/	/	/				9	0	0	0
22-23			/	/		///	//		/			8	-1	-8	8
20-21		//	/		////	////		///	/			15	-2	-30	60
18-19			/	⧻ //	⧻ ⧻	/	////	/	////			29	-3	-87	261
f_x	1	4	8	14	24	16	14	5	7	1		94	N	-11	817
d_x	-4	-3	-2	-1	0	1	2	3	4	5				a	b
$f_x d_x$	-4	-12	-16	-14	0	16	28	15	28	5		46	c		
$f_x d_x^2$	16	36	32	14	0	16	56	45	112	25		352	d		
$f d_y$	0	6	-1	3	-18	9	7	-9	-10	2		-11	e		
$f d_y d_x$	0	-18	2	-3	0	9	14	-27	-40	10		-53	f		

$x = f - \frac{ac}{N} = -53 - \frac{-506}{94}$ $\quad z = b - \frac{a^2}{N} = 817 - \frac{121}{94}$

$y = d - \frac{c^2}{N} = 352 - \frac{2116}{94}$ $\quad r = \frac{x}{\sqrt{yz}} = \frac{-47.62}{\sqrt{329.49 \times 815.71}} = \frac{-47.62}{\sqrt{268778.39}} = \frac{-47.62}{518.44} = \boxed{-.09}$

3. Note that the lowest c.i. on the Y-axis is placed at the bottom of the chart and the lowest c.i. on the X-axis in the extreme left-hand corner.

4. The X- and Y-axes are appropriately labeled.

5. Tally marks are placed in the appropriate boxes for each pair of values which are correlated. For instance, worker #1 is 18 years old and has an intelligence test score of 24, so that her tally is placed in the column 24-26 and on the line 18-19. This tally properly identifies her in respect to these two characteristics.

6. The tally marks are added across each line and their number placed in column f_y.

7. The tally marks are added for each column and their number entered on line f_x.

8. The total for column f_y, which should be the same as the total for line f_x, is entered in the box labeled N and represents the number of cases.

9. A point is chosen on the X- and Y-axes to represent the assumed midpoint of the distributions. This is represented by the zero in column d_x and on line d_x.

10. All c.i.'s having higher values than these zero-points are numbered consecutively on line d_y and in column d_y. Those below that value are numbered consecutively also, but preceded by a minus sign.

11. Column d_y is multiplied by column f_y and the result posted in column $f_y d_y$.

12. Line d_x is multiplied by line f_x and the result posted on line $f_x d_x$.

13. The total of column $f_y d_y$ is entered in box "a" and the total of line $f_x d_x$ in box "c."

14. Column $f_y d_y$ is multiplied by column d_y and the result entered in column $f_y d_y^2$.

15. Line $f_x d_x$ is multiplied by line d_x and the result entered on line $f_x d_x^2$.

16. The total of column $f_y d_y^2$ is entered in box "b" and the total of line $f_x d_x^2$ in box "d."

NOTE: Up to this point, the operations performed on the data on the X- and Y-axes are precisely the same as those necessary to obtain the mean and the Standard Deviation. The steps which follow are the only additions required to obtain the coefficient of correlation.

17. On line fd_y are entered the Y-values of all tally marks in each column along the X-axis. Thus, in the first column the tally mark is on the line numbered zero in column d_y, and the value 0 is entered in the first column on line fd_y. In the second column, there is one mark on line 6, one on line 4, and 2 on line -2, so that a total of 6 is entered in the second column of line fd_y.

18. The total of line fd_y, posted in box "e," should correspond with the figure in box "a."

19. The last line, $fd_y d_x$, is filled out by multiplying line fd_y by the values in line d_x, and the total of this line is placed in box "f."

20. The values which have been computed and placed in the various boxes now are substituted in the formula, and the coefficient of correlation is computed mathematically.

The significance of correlation. In the example which we have chosen, there appears to be a negative correlation between the two sets of data. This indicates that the relationship is a negative one so that there is a tendency for the older employees to be less intelligent or, conversely, for more intelligent employees to be younger. However, this relationship is not a close one so that there will be many exceptions to this general rule.

How close the relationship between two series of values is, is indicated by the size of the coefficient. The closest possible relationship, of course, exists when two such sets cover exactly the same characteristic of the individuals involved, in which case there would be a perfect positive correlation, expressed by the coefficient + 1.00. On the other hand, it is possible to have an equally close relationship when the two measures are exact opposites, and this would result in a perfect negative correlation of — 1.00. In either case, a person's standing in the group on one trait can be predicted with perfect certainty from our knowledge of his standing on the other characteristic; only, in the case of a perfect positive correlation the two would be exactly alike, and in the other case, exactly opposite. In actual practice, of course, no such close relationships are likely to be found, since this would indicate that one of the two measures is superfluous because it adds nothing new to our information concerning the members of the group. The farther the coefficient is removed from the O-point in either direction, the closer is the relationship and hence the greater the predictability of one type of score from the other. When the coefficient approaches the O-point, it indicates that the chances of such prediction are negligible and that any attempt to draw conclusions concerning a person's standing on one variable from this known standing on the other has little more chance of being accurate than if it were a pure guess.

The direction of the relationship is indicated by the preceding sign. When this is positive, the two measures tend to

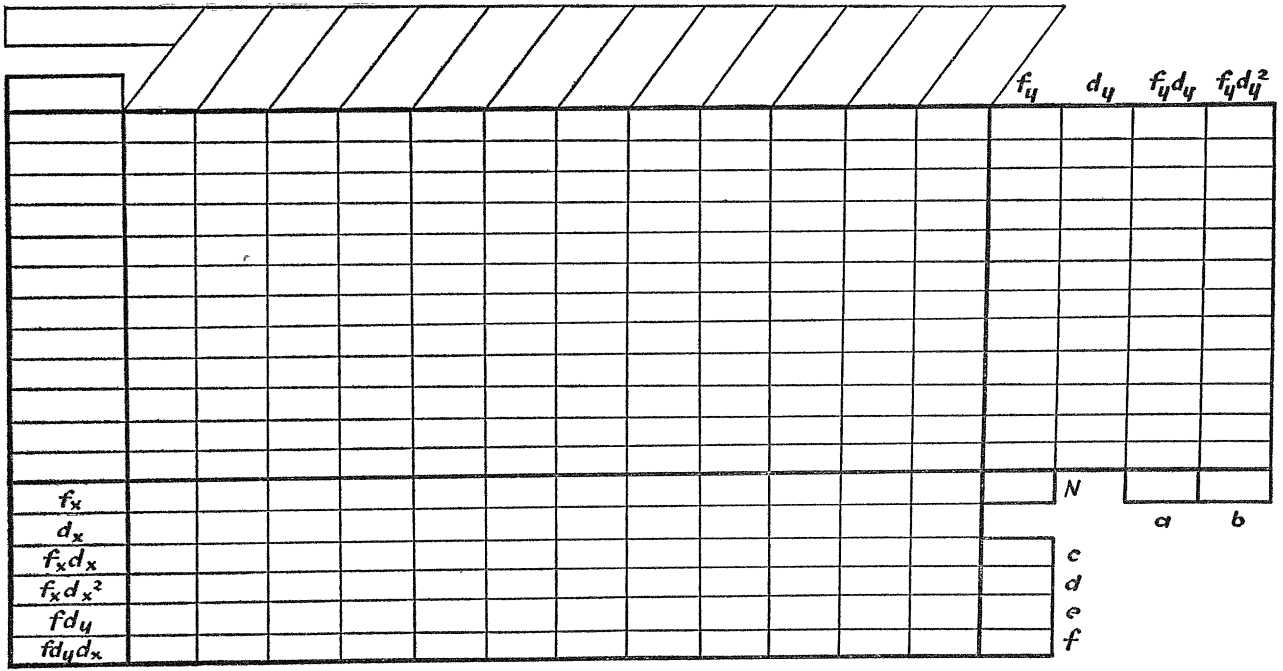
vary together in the same direction, so that a high score on one tends to be associated with a high score on the other more often than with a low score. When the sign is negative, the measures tend to vary in opposite directions, so that a higher score on one tends to be associated with a lower score on the other more frequently than with a higher score.

Assignment VIII

Compute the coefficients of correlation for the following combinations of values, using the correlation charts on the next five pages:

a. intelligence and years of schooling;
b. occupational adjustment* and previous employment experience;
c. dexterity and age;
d. occupational adjustment* and length of service;
e. intelligence and total adjustment.*

* Note that the adjustment scores consist of the number of undesirable answers, so that a positive coefficient would indicate a tendency for those who are poorly adjusted to be higher in the related trait.



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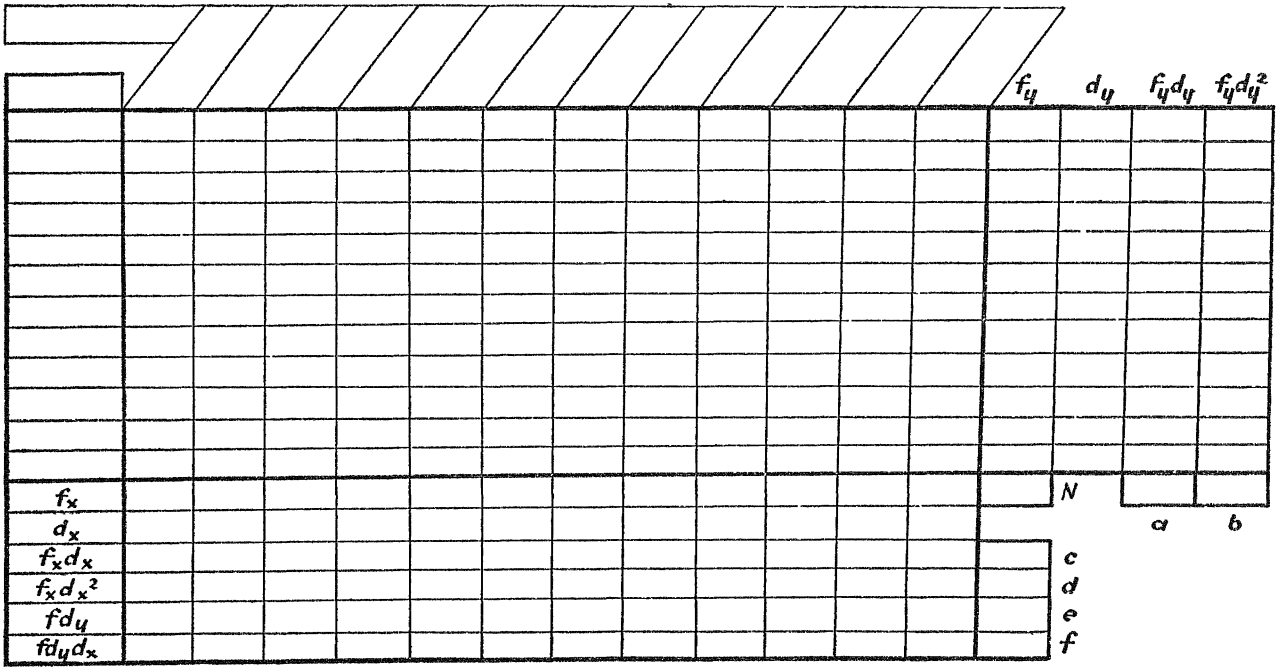

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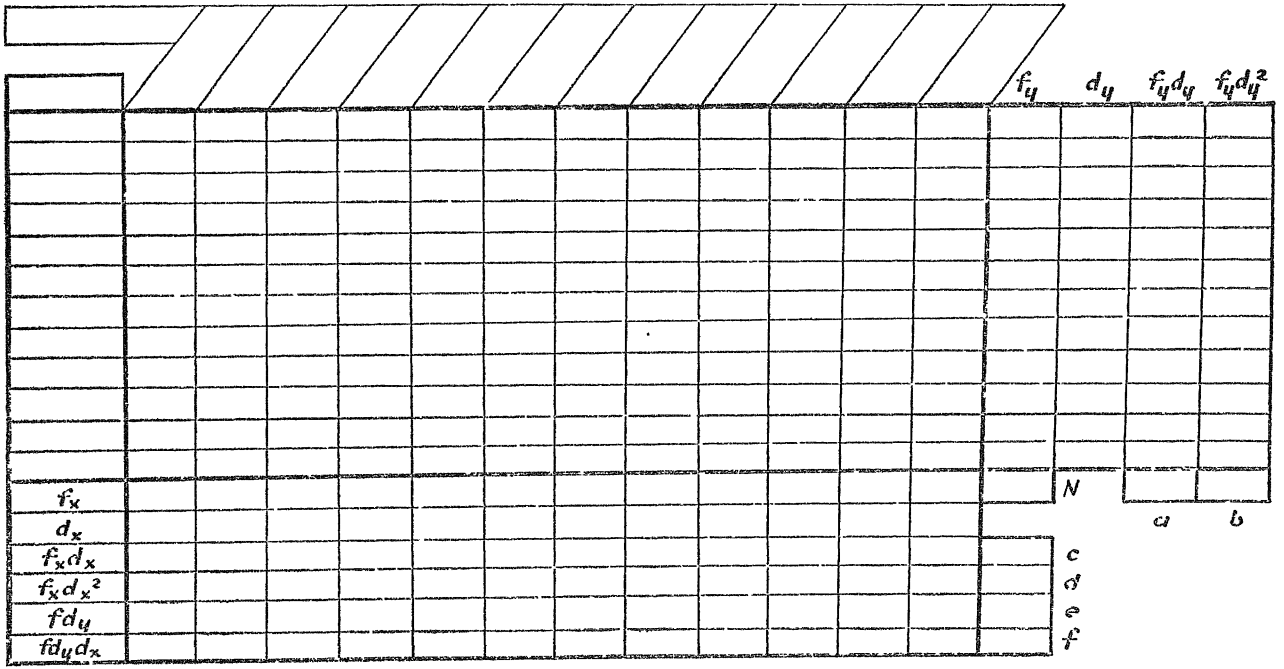

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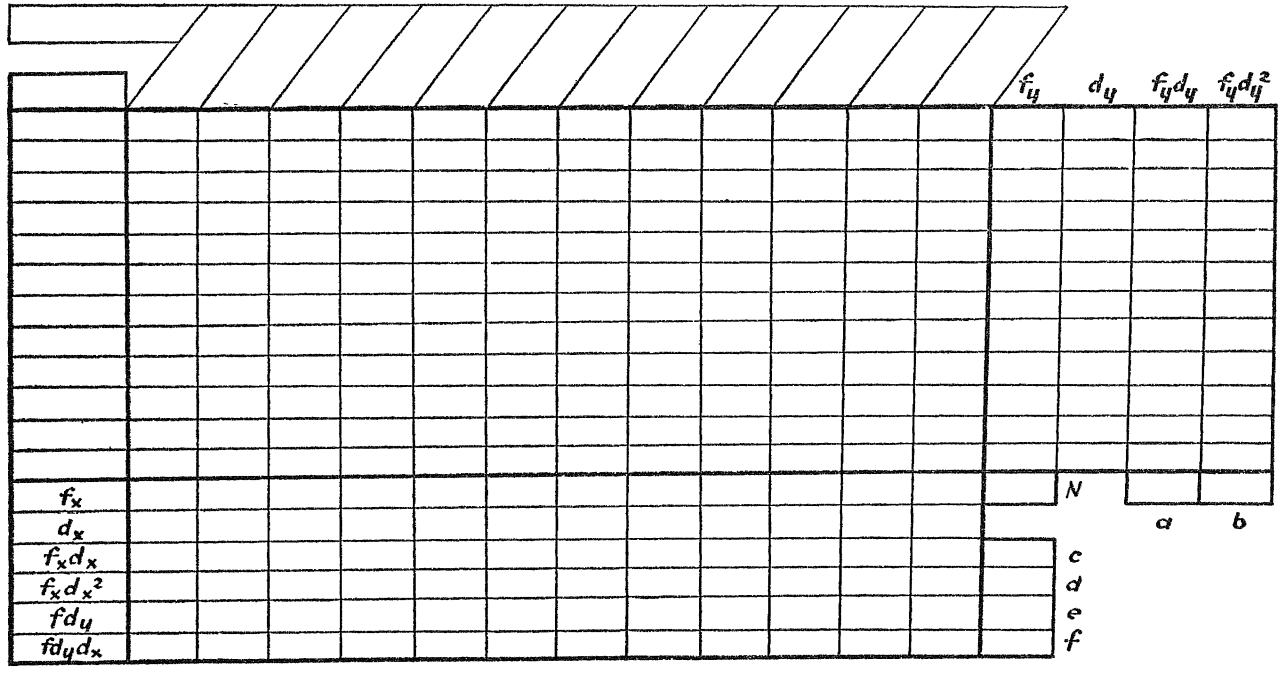
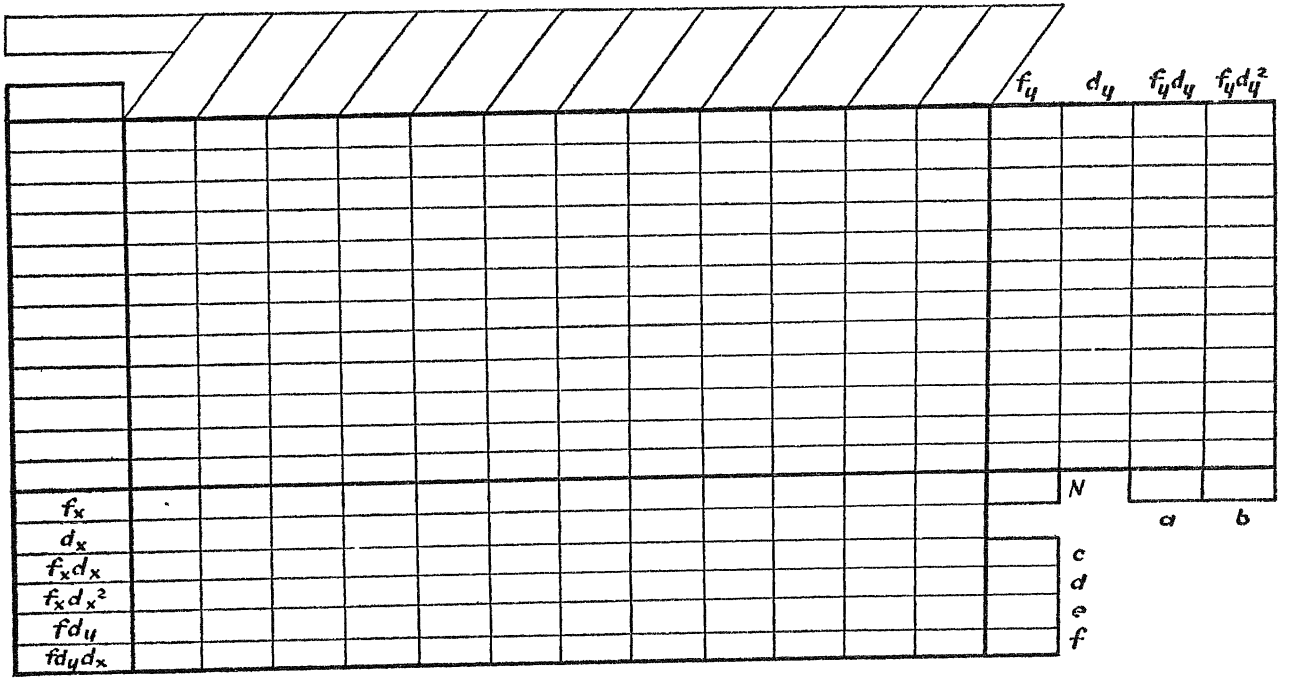


$x = f - \frac{ac}{N} =$ $\quad y = d - \frac{c^2}{N} =$ $\quad z = b - \frac{a^2}{N} =$ $\quad r = \frac{x}{\sqrt{yz}} = \sqrt{\quad} = \sqrt{\quad} = \frac{\quad}{\quad} =$ $\square$


f_y
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$x = f - \frac{ac}{N}$ =
$y = d - \frac{c^2}{N}$ =
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Part II

NOTES, REFERENCES, QUESTIONS, AND APPLICATIONS

INTRODUCTION

The following notes, references, questions, and applications are integrated with the various chapters of *The Psychology of Personnel* in order to provide students and other interested persons with further details of the topics covered in the text and with opportunities for applying this information.

It will be noted that reference is not ordinarily made to psychological research studies nor to conventional psychological textbooks. These are readily available to instructors and students and may be referred to as desired. In the present volume, an effort has been made to call attention to books and articles written from the industrial point of view, pamphlets and other publications prepared by government and semi-official agencies, booklets published by manufacturers of industrial appliances, and similar sources of information which is based primarily on practical industrial experience. As in the text, the emphasis here is experiential rather than theoretical.

Students of the subject may obtain a general orientation in industrial psychology from such books as:

Barnard, Chester I.: *The functions of the executive* (Cambridge: Harvard University Press, 1938).

Mayo, Elton: *The human problems of an industrial civilization* (New York: The Macmillan Co., 1933).

Pigors, Paul, L. C. McKenney, and T. O. Armstrong: *Social problems in labor relations* (New York: McGraw-Hill Book Co., 1939).

Roethlisberger, F. J.: *Management and morale* (Cambridge: Harvard University Press, 1941).

Roethlisberger, F. J., and W. J. Dickson: *Management and the worker* (Cambridge: Harvard Univeristy Press, 1939).

For information on recent developments, the industrial psychologist depends on a number of publications carrying articles on this subject, including:

Advanced Management
Factory Management and Maintenance
Journal of Applied Psychology
Management Review
Modern Industry
Personnel
The Personnel Journal

Bulletins and occasional publications from the following sources provide helpful information on selected topics:

American Management Association: *Personnel Series* and *Production Series*

California Institute of Technology, Industrial Relations Section

Industrial Relations Counselors, Inc.: *Industrial Relations Monographs*

Massachusetts Institute of Technology, Industrial Relations Section

Metropolitan Life Insurance Company, Policyholders Service Bureau

National Industrial Conference Board: *Studies in Personnel Policy* and *Management Record*

Princeton University, Industrial Relations Section

U. S. Department of Labor and its subdivisions

University of Michigan, Industrial Relations Section

Chapter I

UNDERSTANDING EMPLOYEES

Basic Needs

Several studies have been made of the factors in the employment situation which appear to be important to the workers. These indicate that the satisfaction of the needs for *security and recognition* is the chief value which they expect to attain from industrial employment. This may take the form of steady employment, adequate supervision, safety provisions, medical services, or insurance systems and pensions (related to security), or of chances for promotion, voice in management, opportunities for using one's own ideas, or high pay (related to recognition). Among these studies, the following may be referred to:

Hersey, R. B.: *Psychology of workers* (*Personnel Journal,* 1936: 14, 291-296).

Hoppock, R.: *Job satisfaction* (New York: Harper and Bros., 1935).

Houser, J. D.: *What people want from business* (New York: McGraw-Hill Book Co., 1938).

Wyatt, S., J. N. Langdon, and F. G. L. Stock: *Fatigue and boredom in repetitive work* (Industrial Health Research Board Report # 77, 1937).

Much controversial material is available on *social security* and *labor legislation.* The student of industrial psychology will find it to his advantage to consult the several acts in their original. For easy reference, the following is recommended:

Compilation of the Social Security Laws (Washington: Federal Security Agency, Social Security Board, 1941).

Convenient manuals on the principal labor laws have been published by the National Foremen's Institute of Deep River, Conn., at various dates, and include: the Wagner Labor Relations Act, the Walsh-Healy Act, and the Wages and Hours Act.

Individual Differences

Most of the literature available in this field is written from the psychological point of view without reference to the industrial situation. The traditional text for students with a psychological background is:

Anastasi, Anne: *Differential psychology* (New York: The Macmillan Co., 1937).

Interesting facts on the *significance* and *extent* of individual differences in industry are found in such titles as:

Garrett, H. E.: *Forecasting job efficiency* (*Personnel Journal,* 1942: 20, 276-278).

Increasing factory output through better use of employee skills (Production Series #130. New York: American Management Association, 1941).

Shartle, C. L.: *Fitting workers to jobs* (*Personnel Journal,* 1942: 20, 328-333).

In later chapters, frequent reference will be made to the *nature* of individual differences and to the industrial policies and arrangements designed to utilize these differences to the best advantage of employer and employee.

Attitudes

Attempts to measure employee attitudes toward their jobs have not always been successful because it is difficult to

obtain relevant and reliable information. References to the results of some representative studies are given in Chapter X. Some of the following titles suggest a method of approach and should provide cues for further research.

Bergen, H. B.: *Finding out what employees are thinking* (*Management Record,* April, 1939).

Determining employee attitudes (Chicago: Industrial Commentaries #1, 1939).

Hall, O. M.: *Attitudes and unemployment, a comparison of the opinions and attitudes of employed and unemployed men* (Archives of Psychology, 1934: #165).

Kornhauser, A. W.: *The technique of measuring employee attitudes* (*Personnel,* 1933: 9, 99-107).

Kornhauser, A. W., and A. D. Sharp: *Employee attitudes: suggestions from a study in a factory* (*Personnel Journal,* 1932: 10, 393-404).

Likert, R.: *A technique for the measurement of attitudes* (Archives of Psychology, 1932: #140).

Thurstone, L. L., and E. J. Chase: *The measurement of attitude* (Chicago: University of Chicago Press, 1929).

Incentives

Details of industrial incentives are offered in Chapter X, and references on this subject can be examined more profitably after the intervening chapters have been studied.

Name . . . . . .

Score . . . . . .

Questions on Chapter I

T F 1. One of the chief aims of personnel psychology is to modify the workers' social needs so as to bring them in line with industrial goals.

T F 2. Considerable differences are found among the members of a group with respect to the existence of organic needs.

T F 3. The need for security manifests itself in an individual manner in different people.

T F 4. The threat of losing one's job is the most powerful incentive to employee efficiency.

T F 5. Antisocial traits frequently develop in individuals who have received inadequate recognition for socially acceptable behavior.

T F 6. Troublemakers seldom are found among successful workers.

T F 7. Individual competition tends to motivate each individual to turn in the best performance of which he is capable.

T F 8. Industry has found that over-all production standards are most effective in stimulating optimal performance in all workers.

T F 9. Personnel management should attempt to eliminate, in as far as possible, individual differences in the performance of skilled employees.

T F 10. The piece-rate, rather than the hourly wage, system of payment permits differential earnings on the basis of productive capacity.

T F 11. Setting up rigid physical requirements to be met by all applicants for the entire plant is the best insurance against employing incompetent workers.

T F 12. Standards of physical prowess to be met by applicants should be based on the characteristics of present workers.

T F 13. Capacities are potential abilities.

T F 14. The existence of a capacity cannot be determined by measuring an ability.

T F 15. The employment manager is interested in determining present abilities, not capacities.

T F 16. The possession of a marked technical skill is indicative of a high degree of general capacity.

T F 17. The temperament characteristic of a person is determined, in large measure, by glandular factors.

T F 18. Personality traits are based chiefly on neurological factors.

T F 19. Men who are considered good supervisory material usually possess personality characteristics which distinguish them from others.

T F 20. To predict accurately the behavior of persons with certain personality characteristics, their attitudes must be carefully considered.

T F 21. The force and direction of a response can be predicted from the amount of organic energy available in the organism.

T F 22. Through developing industrial skills the workers' energies can be guided in the desired direction.

T F 23. The dominating incentive in industry is a raise in pay.

T F 24. It is unlikely that any form of incentive will be equally effective with all employees.

T F 25. Adequate job adjustment is the over-all goal of personnel management.

Name . . . . . .

Grade . . . . .

Chapter I

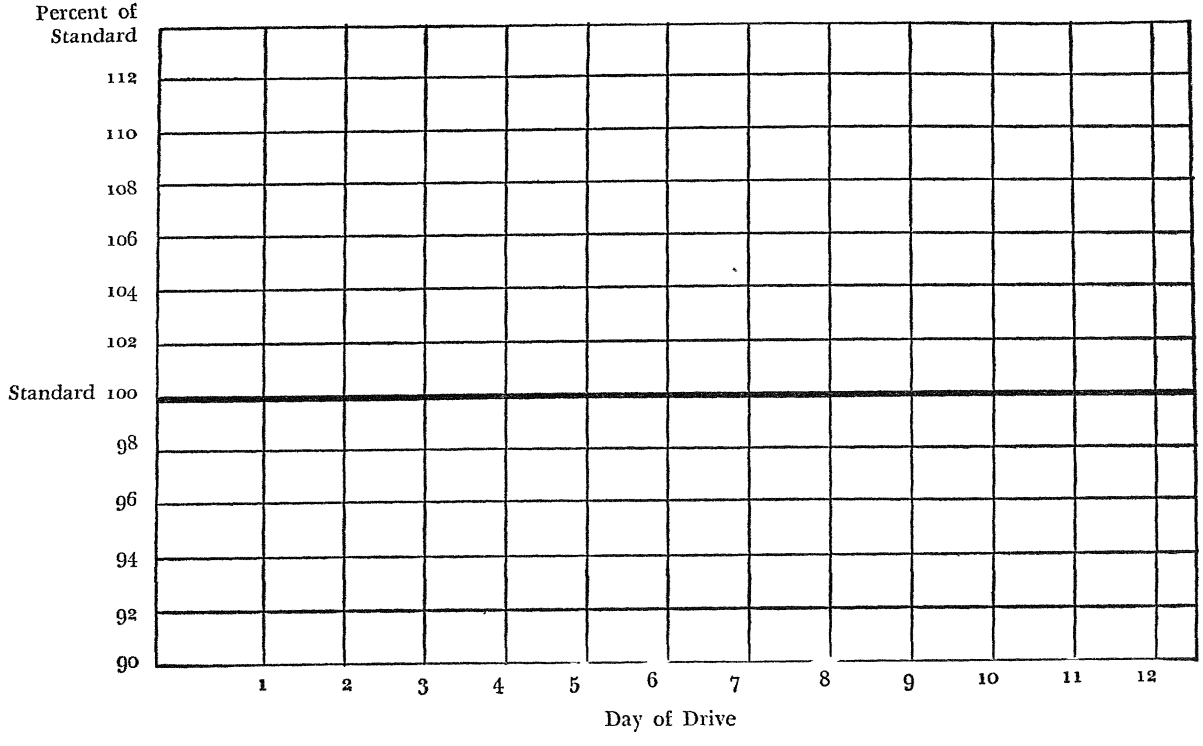
APPLICATIONS

1. Give an example from your own experience to illustrate how recognition may eventually be obtained after initial failure.

2. A certain company is putting on a production drive and wishes to determine its effectiveness. Prepare a production chart for the five workers whose average production during the past three months has been as follows: A 20 units, B 22 units, C 25 units, D 24 units, and E 18 units per day. These individual averages are to be considered standard performance for each man, and to be represented by a single solid line on the chart. The data to be plotted are their performances during the twelve days of the drive, as follows:

Day	Number of Units Produced				
	A	B	C	D	E
1	19	21	24	24	17
2	21	23	27	26	18
3	22	22	27	24	19
4	21	23	26	24	18
5	19	20	25	22	17
6		20	24	22	18
7	19	21	25	23	17
8	22	24	26	.	19
9	22	22	28	25	20
10	20	21	24	25	18
11	21	23	26	24	19
12	19	20	24	24	18

Production Chart



Name .....

3. Answer the following questions concerning the results of this production drive:

   a. Has the drive been a success in this department? Why or why not?

   b. Which of these five men showed the greatest improvement in his production during the drive? How much above standard was his performance?

4. What are the *economic* implications of the fact that two workers, paid on an hourly basis, average 45 and 60 units per day, respectively, while the plant average is 52 units per day? How would a piece-rate-plus-bonus plan affect the situation?

5. Describe in your own words the relationship among a worker's (a) available energy, (b) needs and wants, (c) working conditions, (d) morale, and (e) success on the job.

Chapter II

ANALYZING JOBS

Job Descriptions and Specifications

The basic tool in writing job descriptions and specifications is the job breakdown. Below is a sample breakdown of a simple operation. Note that the left-hand column contains the essential steps in the operation, each step being a segment which contributes to the complete performance. The right-hand column lists the key points, routine manipulations, and techniques which must be understood or learned as a prerequisite of adequate performance. From these, the qualifications of the operator are to be obtained.

Equipment: fountain pen, Parker 51; bottle of ink; tissues.	*Operation:* filling pen
1. Remove cap	1. Hold barrel (r); remove cap (l); place cap on desk (l)
2. Remove tip	2. Hold barrel (l); unscrew tip (r); place tip on desk (r)
3. Insert pen in bottle	3. Steady bottle (l); hold pen vertical (r), grasping barrel between fingers 2 and 3
4. Fill barrel	4. Depress plunger 4 or 5 times by alternately pressing down with thumb and releasing

5. Remove pen from bottle	5. Raise pen with wrist motion (r)
6. Clean point	6. Hold barrel (r); wipe point with tissue paper (l)
7. Replace tip	7. Hold barrel (l); pick up tip from desk and screw in place (r)
8. Replace cap	8. Hold barrel (r); pick up cap from desk and replace (l)

(Note: "r" indicates right hand, "l" left hand).

The steps listed in the left-hand column form the basis for the time study and should be individually timed with a stop watch. The key points on the right should be checked for efficiency and any apparently unnecessary motions eliminated. If this analysis is to be used for the purpose of setting job standards, it is essential that the workers whose motions are studied be of average skill and ability, neither beginners nor experts, and that they operate at their usual level of efficiency and under conditions which are normal for them. Several observations must be made of several operators and the average of their performances taken as the standard time and method for the job.

Time and Motion Studies

The technique of writing time and motion analyses of industrial operations is simple in principle but requires considerable practice and skill for adequate performance. It is not to be expected that students will acquire more than an elementary knowledge of this technique in their classrooms, but this should be sufficient to enable them to participate in time and motion studies in industry under proper supervision.

Descriptions of the procedure are given in:

Maynard, Harold B., and G. J. Stegemerten: *Operation analysis* (New York: McGraw Hill Book Co., 1939).

Production standards for time study analysis, Book Two (Detroit: Local #2, UAW-CIO and The Murray Corporation of America, 1942).

Standards of Work

The relationship between job studies and work standards is so close that many companies have obtained the cooperation of their workers in making the analyses necessary for setting standards. In this manner, production standards are more readily accepted by labor because its representatives had a vital part in their preparation. Examples of such collaboration are given in the following publications:

Production standards for time study analysis, Book One (Detroit: Local #2, UAW-CIO and The Murray Corporation of America, 1942).

Riegel, John W.: *Obtaining employee acceptance of production standards* (in: *Personnel management in war industries;* Vol. II, 1-13. Ann Arbor: University of Michigan Press, 1944).

The administration of production standards in The Murray Corporation (in: *Personnel management in war industries;* Vol. II, 19-24. Ann Arbor: University of Michigan Press, 1944).

Job Classification

Many useful aids are available to the industrialist and student wishing to apply job descriptions to job evaluation and classification. Among the best titles on this subject are:

Balderston, C. C.: *Wage setting based on job analysis and evaluation* (New York: Industrial Relations Counselors, 1940).

Benge, Eugene J., Samuel L. H. Burk, and Edward N. Hay: *Manual of job evaluation* (New York: Harper and Bros., 1941).

Gray, Robert D.: *Classification of jobs in small companies* (Pasadena: California Institute of Technology, 1943).

Gray, Robert D.: *Systematic wage administration in the Southern California aircraft industry* (New York: Industrial Relations Counselors, 1943).

Knowles, Asa S., and Thomas M. McAuley: *Salary evaluation* (Boston: Northeastern University, 1941).

Riegel, John W.: *Salary determination* (Ann Arbor: University of Michigan Bureau of Industrial Relations, 1940).

Riegel, John W.: *Wage determination* (Ann Arbor: University of Michigan Bureau of Industrial Relations, 1937).

Special Jobs

Advisory standards for the safe employment of *young workers* have been set up by the United States Department of Labor, Children's Bureau, and are available in the following fields: shipbuilding, lead and lead-using industries, employment involving exposure to carbon disulfide, employment involving exposure to chlorinated solvents, welding occupations, operation of metal-working machines, and the aircraft industry.

The Women's Bureau of the United States Department of Labor has available several publications dealing with proper provisions for the employment of *women* in industry. Also, see:

Assimilating women workers (Production Series #141. New York: American Management Association, 1942).

Trembly, Alfred G.: *The distinct problem of women employees* (Chicago: Van Hoesen, 1940).

There is a growing literature in the field of *disabled workers,* particularly veterans. The War and Navy Departments have published pamphlets on this subject which are referred to elsewhere; many of the leading industrial and psychological journals contain articles on techniques and results of employing disabled men. For a general discussion, the following titles are suggested:

Deaver, George G., and Mary E. Brown: *Physical demands of daily life* (New York: Institute for the Crippled and Disabled, 1915).

The placement and utilization of disabled veterans (in: *Personnel management in war industries;* Vol. II, 85-96. Ann Arbor: University of Michigan Press, 1944).

Rehabilitation (Chicago: American Mutual Alliance, 1944).

Untapped manpower (Washington: United States Civil Service Commission, 1944).

Name . . . . . .

Score . . . . . .

Questions on Chapter II

T F 1. The job specification should include a statement of the level of skill necessary for adequate performance.

T F 2. Because the statement of level of skill implies a certain amount of previous experience, no separate entry need be made for extent of experience in the job specification.

T F 3. The aggressive type of personality is likely to succeed in any kind of job.

T F 4. It is generally true that a foreman or skilled operator knows the job so well that he can explain and demonstrate it to the novice without need of referring to a job breakdown.

T F 5. Standard operating procedure should include only those operational units which are essential to the job.

T F 6. Time and motion studies are particularly useful as guides in the selection and placement of partially disabled men.

T F 7. Production standards are designed primarily to increase individual output.

T F 8. Quality standards, reduced to their simplest form, are statements of the highest quality level a company can build into its product.

T F 9. The greater the number of items produced above that specified in production standards, the better for labor and management both.

T F 10. The productive capacity of the most skilled worker should not be taken as the basis of production standards.

T F 11. For best results, the observations on which standards are based must be made without the workers' knowledge.

T F 12. Production standards are in terms of weekly or monthly, rather than daily, averages.

T F 13. The job which requires little skill can be performed better by a worker possessing essential information basic to it.

T F 14. Two jobs which require similar qualifications but are dissimilar in duties, may be classified at the same pay level.

T F 15. In an adequate system of job classification, each position normally will lead to only one line of promotions.

T F 16. Within each class of jobs, pay differentials should exist to allow for differences in employee efficiency.

T F 17. It is likely that in most plants a survey of all jobs would disclose many which could be handled by partially disabled persons.

T F 18. The first step in setting up an employment program for disabled veterans is to work out adequate job specifications.

T F 19. The fact that State laws prohibit the hiring of women and young workers on certain jobs shows that jobs are not in themselves dangerous.

T F 20. It is a wise policy to let young workers adjust themselves as rapidly as possible to the work situation without paying special attention to their needs.

T F 21. Of equal importance with the breaking down of a complex job into operational units is indicating the interrelationships of these units.

T F 22. Men who do not perform well on a certain job may become good producers in other operations within the same job family.

T F 23. Jobs within the same family have the same requirements.

T F 24. A skilled operator can be expected to perform well on any job requiring his level of skill.

T F 25. In each plant, definite lower limits of intelligence should be set up for each type of work.

Name . . . . . .

Grade . . . . .

Chapter II

APPLICATIONS

1. Write a job breakdown for a skilled or semi-skilled operation, such as typing or operating a power tool. Enter in the left-hand column the distinct phases involved (e.g.: place tool in vice; tighten screws to hold tool in place; etc.), and in the right-hand column the key points in the operation (e.g.: hold tool (l); adjust screws (r), etc.)

Equipment:	*Operation:*
Job Breakdown	Key Points

2. Suggest job simplifications by examining critically the sequences in the left-hand column and the key points in the right-hand column of your job breakdown.

3. Do the same for the fountain-pen filling operation.

4. A manufacturing concern decides that it will offer employment in its assembly room to a number of disabled veterans. Thus far, only able-bodied persons have been employed. What steps must be taken to determine the kinds of jobs on which disabled men can be employed?

Name . . . . . .

5. Evaluate two industrial jobs by checking in the following table their physical requirements.

Demand:	Job I	Job II
walking		
standing		
sitting		
climbing		
crawling		
stooping		
kneeling		
lifting		
pulling		
pushing		
seeing		

Demand:	Job I	Job II
using		
1 foot		
2 feet		
1 hand		
2 hands		
fingers		
talking		
hearing		

Job I is . . . . . .

Job II is . . . . . .

Chapter III

SELECTING EMPLOYEES

Evaluating Experience

Certain reference volumes are indispensable in interpreting civilian occupational experiences. Included in these are:

Dictionary of occupational titles, Parts I, II, IV, and Supplement (Washington: United States Department of Labor, United States Employment Service, 1939).

Job descriptions (Washington: United States Department of Labor, United States Employment Service).

Job family series (Washington: War Manpower Commission).

Standard industrial classification manual, Volumes I and II (Washington: Bureau of the Budget, 1942).

To these should be added, in the case of veterans, the following volumes which are indispensable in interpreting occupational experiences in the armed forces:

Civilian occupational classification of enlisted personnel (Washington: War Department, 1 July 1944. TM 12-426).

Military occupational classification of enlisted personnel (Washington: War Department, 12 July 1944. TM 12-427).

Officer classification—commissioned and warrant (Washington: War Department, 30 October 1943 and 1 July 1944. TM 12-405).

Personnel classification (Washington: War Department, 17 June 1944. TM 12-425).

Special aids for placing army personnel in civilian jobs (Washington: War Manpower Commission).

Special aids for placing navy personnel in civilian jobs (Washington: War Manpower Commission).

Measuring Devices

The volume of literature in the field of testing is considerable, but most of it is of interest chiefly to the psychometric expert. The industrialist wishing to include tests as part of his selection program would be well advised to avail himself of the services of a competent psychologist. Only a person who is experienced in this field is capable of selecting the testing devices which best meet the individual needs of a given situation.

A general idea of the wide variety of tests now available (and numbering in the vicinity of over 3,000 titles) may be obtained by examining such volumes as:

Buros, Oscar K.: *The 1938 mental measurements yearbook* (Rutgers University Press, 1938).

Employment tests in industry and business (Princeton University Industrial Relations Section, 1945).

Hildreth, Gertrude H.: *A bibliography of mental tests and rating scales* (New York: Psychological Corporation, 1939).

From among the many recent publications discussing the practical value of tests in helping solve specific employment problems, the following are selected as representing a fair cross section of opinion and experience from widely differing types of business and industry:

Benson, R. W.: *Testing for mental alertness* (*Management Review,* 1941: 30, 287-288).

Bingham, Walter V.: *Testing for aptitudes* (*Personnel Journal,* 1937: 15, 264-272).

Cummings, H. J.: *Aptitude test for salesmen* (*Management Review,* 1939: 28, 398-399).

Davidson, Charles M.: *Analysis of clerical tests* (*Personnel Journal,* 1937: 16, 95-98).

Davidson, Charles M.: *Evaluation of clerical tests* (*Personnel Journal,* 1937: 16, 57-64).

Drake, Charles A.: *Aptitude testing* (*Personnel Journal,* 1940: 18, 340-345).

Drake, Charles A.: *Inspection for inspectors* (*American Machinist,* 1938: 82, 776-778).

Drake, Charles A.: *Job tests* (*Personnel Journal,* 1941: 20, 184-189).

Drury, Lynn B.: *Selecting employees for advancement* (*Personnel Journal,* 1941: 20, 166-171).

Employment procedures and personnel reports (Studies in Personnel Policy #38. New York: National Industrial Conference Board, 1941).

Employment tests in industry and business (Princeton University Industrial Relations Section, 1945).

Garrett, H. E.: *Forecasting job efficiency* (*Personnel Journal,* 1942: 20, 276-278).

Hay, Edward N.: *Tests in industry: their proper use* (*Personnel Journal,* 1941: 20, 13-15).

How accurately can aptitude tests appraise potential sales ability? (*Sales Management,* 1938: 43, 56).

Introductory tests for salesmen (*Management Review,* 1941: 30, 188-189).

Levine, H.: *Practical Civil Service examinations for manual jobs (Personnel Journal,* 1941: 19, 348-353).

Palmerston, L. R.: *Psychological tests in industry and education (Personnel Journal,* 1941: 19, 325-335).

Psychological aids in the selection of workers (Personnel Series #50. New York: American Management Association, 1941).

Schroedel, E. C.: *Testing employees (Management Review,* 1940: 29, 240-241).

Schultz, Richard T.: *Personnel selection in aviation industry (Personnel Journal,* 1941: 19, 99-107).

Shartle, C. L.: *Fitting workers to jobs (Personnel Journal,* 1942: 20, 328-333).

Solomon, R. S.: *Do your tests pick good workers? (Personnel Journal,* 1941: 20, 177-183).

Square peg "problem employees" find square holes with aptitude tests (Sales Management, 1941: 48, 17-20).

Testing for talent (Fortune, 1941: 23, 68-71 and 95-96).

Tests help you hire right (Factory Management, 1941: 99, 77-80).

Wordsworth, G. W., Jr.: *Hiring for better labor relations (Personnel Journal,* 1939: 18, 51-60).

Interviewing

There are many good books and other types of publications dealing with interviewing techniques. Among the better ones are the following:

Bingham, Walter V., and Bruce V. Moore: *How to interview* (New York: Harper and Bros., 1931).

Garrett, Annette: *Interviewing, its principles and techniques* (New York: Family Welfare Association of America, 1942).

Mandell, Milton: *Civil Service oral interviews (Personnel Journal,* 1940: 18, 373-382).

Oral tests in public personnel selection (Chicago: Civil Service Assembly, 1943).

Ordway, Samuel H., and James C. O'Brien: *New methods of interview hiring (Personnel Journal,* 1939: 18, 128-139).

Purcell, Dale B.: *Hiring interviews (Personnel Journal,* 1944: 22, 263-267).

Silvers, C. L.: *Talking it over (Personnel Journal,* 1943: 22, 330-339).

Specific aids for interviewers are available from several sources, including these:

The Psychological Corporation, New York, publishes a manual for interviewers and an employee evaluation form for interviews. The former presents the needed background for this type of work, and the latter provides spaces for recording significant responses and ratings in seven areas of the applicant's background.

Science Research Associates, Chicago, publishes various interview aids prepared by Purdue University, including an interviewer's rating scale, and several simple oral trade tests including such skills as reading a drawing, a micrometer, and a scale.

Name

Score

Questions on Chapter III

T F 1. During the war, unusual emphasis has been placed on the capacities rather than on the existing abilities of rank-and-file employees.

T F 2. The "upper and lower thirds" technique is useful in setting criteria for selecting workers.

T F 3. Army experience may safely be accepted as equivalent to civilian industrial experience in determining the applicant's qualification for a skilled job.

T F 4. Relative rather than absolute pay levels determine what is adequate compensation.

T F 5. In some kinds of work, any sort of previous job experience extending over three years is preferable to specific job experience extending over three months.

T F 6. It is possible to work out a system for grading personal history blanks on the basis of the extent to which its various items are related to job success.

T F 7. Because of their subjectivity, references are of little significance in determining the desirability of applicants.

T F 8. Tests serve the purpose of setting up standard situations to discriminate among applicants on the basis of their differential responses.

T F 9. A test is reliable if it actually measures a significant trait.

T F 10. As long as a test is known to be reliable, it need not be valid to be useful.

T F 11. It is likely that different tests must be used to select workers for widely diverging jobs in the same plant.

T F 12. Trade tests consisting of informational items are too simple to have much industrial usefulness.

T F 13. Job samples are easier to administer than tests of basic skills.

T F 14. The presence of a potential trait can be concluded only from the existence of a related actual trait.

T F 15. High scores on an intelligence test indicate considerable aptitude for learning any kind of skill.

T F 16. The low correlation between intelligence scores and mechanical skill indicates that workers who are good mechanics tend to be low in intelligence.

T F 17. A testing program that has worked well in a given plant may be expected to function equally well in another plant.

T F 18. Comparable scores are indices of the performance of the individual relative to the average performance of his group.

T F 19. When a critical score is selected which must be equalled or surpassed by all successful applicants, it is to be expected that some low-scoring, high-performing workers will be eliminated.

T F 20. Tests eventually may be expected to replace the interview in the selective process.

T F 21. The employment interviewer should begin by asking the applicant to state his name and tell about his past experience.

T F 22. It is good interviewing technique to let the applicant guide the discussion.

T F 23. The interviewer should indicate clearly his approval or disapproval of the applicant's statements in order to acquaint him with the company's attitude and code of ethics.

T F 24. Applicants can be placed properly only if they meet specific job requirements as well as general company standards.

T F 25. An important aspect of follow-up work is checking on the effectiveness of selection and placement.

Name .

Grade

Chapter III

APPLICATIONS

1. Assuming that the rated "value to the company" in Table I is an adequate measure of job success, determine by the upper and lower thirds method whether "marital status" and "living conditions" can be used as criteria for selecting employees for this tool plant. Use the combined value of the two ratings.

Marital Status and Living Conditions in Relation to Rated Job Success

Characteristic	Rated high	Rated low
Number of cases		
A. Number married		
% of total		
Number single		
% of total		
Others		
% of total		
B. Number renting		
% of total		
Number living at home		
% of total		
Number owning home		
% of total		

2. Should "age" and "years of schooling" be included in the personal history blank of this plant? To answer this question, find the extent to which these items differentiate between employees rated most and least valuable to the company.

AGE AND SCHOOLING RELATED TO JOB SUCCESS

Characteristic	Most valuable	Least valuable
Number of cases		
Age:		
Mean		
Median		
A.D.		
Schooling:		
Mean		
Median		
A.D.		

3. If it is found that the correlation between success on a given job and each of the following items: age, years of schooling, number of dependents, and years of experience, are respectively .28, .23, .11, and .17, what approximate weights should be attached to these items on the personal history blank?

Name ....

4. On the basis of your job breakdown in Assignment II, list the items to be covered in interviewing applicants for this job, the traits which should be tested, and the types of experience that seems desirable.

Interview items:	Trait tests:	Experience:

5. How can employees be selected on the basis of expected performance on a drilling machine when only their scores on a mechanical aptitude test are known and there is no opportunity for a job sample?

CHAPTER IV

TRAINING EMPLOYEES

Types of Industrial Training

General discussions of the various *types* of industrial training and of the *methods* most suitable in each case may be found in:

Cushman, Frank: *Training procedure* (New York: John Wiley and Sons, 1940).

Dodd, Alvin E., and James O. Rice: *How to train workers for war industries* (New York: Harper and Bros., 1942).

Intensive training of industrial employees (New York: Metropolitan Life Insurance Company, Policyholders Service Bureau, 1940).

Full information concerning the *standards for apprentices* set up by the War Manpower Commission may be obtained from two publications of its Apprentice Training Service:

Apprentice training for America's youth

The national apprenticeship program

Examples of complete apprentice training programs *provided by the company* are given in such pamphlets as the following:

Job methods training and other production helps (Production Series #140. New York: American Management Association, 1942).

Upgrading and training in a large steel corporation (Example #9. Washington: War Manpower Commission, Training Within Industry Division).

Westinghouse training programs and educational opportunities (Pittsburgh: Westinghouse Electric and Manufacturing Company).

Useful publications are prepared by the Training Within Industry Division of the War Manpower Commission for the purpose of orientation in this field. Among these are:

Developing all-round skilled craftsmen through apprenticeship (Bulletin #3).

How to break in a man on a new job (Bulletin #2-c).

Introducing the new employee to the job (Bulletin #8).

Details of *cooperative programs* in which classroom work is provided by one agency and practical training by another, are found in such publications as the following:

Bedell, Earl L., and Frank Carpenter: *Cooperative training in automotive maintenance* (*Industrial Arts and Vocational Education,* 1936: 19, 327-329).

Detroit's training program grows (*American Machinist,* 1937: 81, 363-365).

Educational opportunities for Westinghouse employees (Pittsburgh: Westinghouse Electric and Manufacturing Company).

George Westinghouse scholarships in Carnegie Institute of Technology (Pittsburgh: Westinghouse Electric and Manufacturing Company).

Meeting the needs for skilled workers in a new airplane engine plant (Example #4. Washington: War Manpower Commission, Training Within Industry Division).

Rochester Athenaeum and Mechanics Institute, Bulletins.

Training apprentices for war and postwar work (Washington: War Manpower Commission, Apprentice Training Service).

Company-operated pre-employment courses (*vestibule schools*) for skilled workers are discussed in:

Meeting the needs for skilled workers in a new airplane engine plant (Example #4. Washington: War Manpower Commission, Training Within Industry Division).

Tying in preemployment training with on-the-job training (Bulletin #6. Washington: War Manpower Commission, Training Within Industry Division).

Examples of *company-operated schools* for new workers may be found in the following titles:

Educational opportunities for Westinghouse employees (Pittsburgh: Westinghouse Electric and Manufacturing Company).

Gronseth, H. E.: *Ford's vocational schools* (*Automotive Industry,* 1936: 75, 276-278).

How to set up a plant training program (Bulletin #4-E. Washington: War Manpower Commission, Training Within Industry Division).

Industrial training programs for increased production (Production Series #126. New York: American Management Association, 1940).

Training for arc welding and acetylene burning in a shipyard (Washington: War Manpower Commission, Training Within Industry Division).

Training for quick production in heavy manufacturing (Example #6. Washington: War Manpower Commission, Training Within Industry Division).

Westinghouse training programs and educational opportunities (Pittsburgh: Westinghouse Electric and Manufacturing Company).

Direct induction methods designed to train production specialists and used by companies quoted in the text are illustrated in:

Training workers for toolroom and machine repairs (Washington: War Manpower Commission, Training Within Industry Division).

The elaborate *in-service training* program maintained by the General Motors Corporation is discussed in:

Training for today and for new horizons tomorrow (Flint: General Motors Institute, 1939).

Full details of the breaking down of highly skilled operations, the training of operational specialists for initial production, and their retraining for upgrading, are offered in:

Training for the electrical department of a shipyard (Example #100. Washington: War Manpower Commission, Training Within Industry Division).

Suggestions for organizing training programs for *upgrading* are given in the following bulletins of the Training Within Industry Division of the War Manpower Commission:

Improving supervisors' knowledge of responsibilities (#4-B).

Supplementary instructions for upgrading (#6-A).

Upgrading (#2).

The *government-sponsored* in-service training program of the Training Within Industry Division of the War Manpower Commission is outlined in detail in its Bulletin #1, issued in 1943.

Industrial Training Aids

The United States Office of Education, through its Division of Visual Aids for War Training, has produced a series of visual training aids which promises to become standard equipment in every organization in which employees are trained for their jobs. Each unit consists of

a 16 mm. sound motion picture
a 35 mm. silent filmstrip
an instructor's manual.

Some of this material has been released by the Army and Navy and was designed for their specialist training programs; other items have been made and released specifically for civilian training in a wide variety of subjects, ranging from machine-shop work and shipbuilding to farm work, nursing, and home canning. Castle Films of New York is the distributor of this series, consisting of 457 visual units, complete information on which is given in the official catalogue and in a monthly "Newsletter" issued by the Office of Education.

Name . . . . . .

Score . . . . . .

Questions on Chapter IV

T F 1. Job training is the principal element in vertical upgrading.

T F 2. In the initial phases of instruction, care should be taken to train men in the elements of the job in the same order in which they eventually are to be perfomed.

T F 3. The informational method of training is designed to develop attitudes rather than abilities.

T F 4. The apprentice system of training is one of the most recent industrial developments.

T F 5. Cooperative training programs are designed to eliminate on-the-job training.

T F 6. Company schools, in general, reach further in their training aims than do vestibule schools.

T F 7. Training workers on the job should, when possible, be combined with related instruction outside the shop.

T F 8. Rotation is a method of training for horizontal and, indirectly, for vertical upgrading.

T F 9. When complicated jobs are broken up into specialties, the training aim is to make each specialist the equivalent of an all-around journeyman.

T F 10. During the war, some companies have found it possible to solve the problem of long-time training of high-grade workers by job simplification.

T F 11. Production-minded foremen are likely to object to a training program in which skilled workers are used as instructors.

T F 12. Even in companies where on-the-job training is left to the foreman, a special training department may be maintained to provide related instruction.

T F 13. The concepts involved in liberal education and in training production specialists are essentially similar.

T F 14. Determining the results of a training program involves the use of a control group.

T F 15. Probably, the maintenance cost of a non-productive machine in regular use in the vestibule school tends to be higher than that of a productive machine in the main plant.

T F 16. Personality traits are not important in considering men for horizontal upgrading, though they are essential considerations in promotion to higher levels.

T F 17. The conference method presupposes that all participants have roughly similar backgrounds of experience.

T F 18. It is customary not to pay wages to apprentices, while those in vestibule schools usually are paid.

T F 19. Many employers object to the cooperative plan because it enables them to fill a job only part of the year.

T F 20. The advantage of vestibule schools is that the work is performed under actual shop conditions.

T F 21. During the reconversion period, in-service training of wartime workers may well be more essential than apprentice training.

T F 22. Not always is the new worker's training completed at the beginning of his employment: he may be required to return to the training department periodically as he progresses in the company.

T F 23. Cooperative training programs are paralleled by company schools in which related instruction is coordinated with on-the-job training.

T F 24. It is to be expected that postwar industries will lower their selection requirements for trainees.

T F 25. Techniques for selecting trainees have been developed to a higher point of excellence than techniques of training.

Name . . . . . .

Grade .....

Chapter IV

APPLICATIONS

Assuming that you are charged with the responsibility of setting up a training program for an industrial plant, already in operation, employing 1,500 employees—what steps would you take to:

a. determine the areas in which training should be provided for present employees;

b. provide adequate training for new employees, considering both the method of instruction and the subjects covered;

c. discover employees capable of being upgraded and provide special programs for them;

d. develop a capable staff of foremen;

e. check on the results of your program of initial training?

Chapter V

WORKING CONDITIONS

Sanitation

The importance attached by forward-looking management to properly kept plants is illustrated in an article dealing with the Johnson and Johnson factories:

His "factories of the future" pay profits—today (*Modern Industry,* 1945: 5, 58-70).

Good general discussions of the problems of industrial hygiene may be found in:

Chenoweth, Laurence B., and Willard Machle: *Industrial Hygiene* (New York: F. W. Crofts Co., 1938).

Protecting plant manpower (Special Bulletin #3. Washington: United States Department of Labor, Division of Labor Standards, 1941).

New designs of equipment for washrooms and other sanitary facilities, including wash fountains, multi-stalled showers, and drinking fountains, are shown in the catalogues of manufacturers of this type of equipment, such as the Bradley Washfountain Company of Milwaukee.

Illumination

For a general discussion of the importance of adequate illumination in industrial situations, see:

Austin, W. J.: *Operating advantages of controlled conditions plants* (*Illuminating Engineer,* 1941: 36, 99).

Lighting and air conditioning for the modern plant (Production Series #118. New York: American Management Association, 1940).

Luckiesh, Matthew, and Frank K. Moss: *Visibility and ease of seeing* (*Industrial Medicine,* 1940: 9, 33).

Value of good lighting in war production (*Illuminating Engineer,* 1943: 38, 13-23).

The practical application of illumination research is stressed in several manuals published by companies manufacturing industrial lighting equipment. Among these are the following:

Balanced lighting (Fostoria: The Fostoria Pressed Steel Corporation).

Is good lighting important in wartime? (Ipswich: Sylvania Electric Products, Inc.).

It pays to send a man to do a man's job (Fostoria: The Fostoria Pressed Steel Corporation).

Specifications for productive lighting in war plants (Des Plaines: Benjamin Electric Manufacturing Company, 1942).

Temperature

An effective presentation of the need for regulating temperature and examples of different types of installations are presented in pamphlets issued by the manufacturers of heating and air-conditioning equipment. See, for instance, those published by Chrysler Airtemp of Dayton: *Chrysler Airtemp at war,* and *Efficiency by degrees.*

Ventilation

A general discussion of the importance of *control* of atmospheric conditions is found in:

Effects of environment and atmospheric conditions on workers (Production Series #119. New York: American Management Association, 1940).

For detailed descriptions of ventilation by means of *fans,* see the catalogues of companies manufacturing this type of equipment, such as Propellair, Inc., of Springfield.

Information on specific ventilating problems is available from various sources. Control of atmospheric and process *dusts* by means of filtered air and exhaust systems is the topic of two publications of the American Air Filter Company of Louisville: *A.A.F. in industry* (1944) and *Roto-Clone dust control* (1940).

The technique of combatting airborne infections by means of *radiation* is discussed in:

Dick, George F.: *Disinfection by radiation* (*Modern Hospital,* 1939, 53: 5, 1-3).

Fitness in industry and its maintenance by indoor sunbaths (Newark: Hanovia Chemical and Manufacturing Company).

Hanovia's ultraviolet "lighthouse" (Newark: Hanovia Chemical and Manufacturing Company).

Wills, William F.: *Sanitary ventilation by radiant disinfection* (*Scientific Monthly,* 1945, 60: 5, 325-334).

Noise

Through the efforts of the National Noise Abatement Council, considerable impetus has been given to the movement to reduce industrial noises. This organization publishes a "News Bulletin" and occasional materials designed to aid

in this undertaking, and promotes interest by making annual awards for noise reduction to industries and communities. The following reference discusses the basic problem of noise:

Sabine, Paul E.: *The problem of industrial noise* (*American Journal of Public Health,* 1944: 34, 3, 265-270).

Music in Industry

There seems to be little doubt that music in industry is here to stay, both during working hours and rest periods. However, to get the maximum benefit from musical programs, it is necessary to consider the experience of long-time users, both as to selections to be played and the time at which they are most effective. This information is available from:

Beckett, Wheeler: *Music in war plants* (Washington: War Production Drive Headquarters, 1943).

RCA Sound Review (A monthly publication, superceding *Industrial Music News.* Camden: RCA Victor Division).

Tindall, G. M.: *Rhythm for the restless* (*Personnel Journal,* 1937: 16, 120-124).

Hours of Work

Of the many recent publications in which company experience with different hours of work are reported, the following may be of interest:

Hours of work in relation to health and efficiency (Albany: New York State Department of Labor, 1941).

Optimum hours of work in war production (Princeton University Industrial Relations Section, 1942).

Solving the manpower problem (Production Series #138. New York: American Management Association, 1942).

What work schedules are best? (in: *Personnel Management in War Industries,* Vol. II. Ann Arbor: University of Michigan Press, 1944).

Multiple-shift Operation

Management's experience in multiple-shift operation can be gathered from such publications as these:

Case studies in training and multiple shift operation (Production Series #132, New York: American Management Association, 1942).

Company problems of multiple shift operation (Production Series #125. New York: American Management Association, 1940).

Shift schedules for continuous operation (Princeton University Industrial Relations Section, 1942).

Name . . . . . .

Score .

Questions on Chapter V

T F 1. The distribution of light is, generally speaking, more important to efficient operation than light intensity.

T F 2. For each kind of work there is a range of optimal light intensity.

T F 3. An indirect result of proper lighting is better sanitation.

T F 4. The purpose of air conditioning is to reduce humidity as much as possible.

T F 5. Fluctuations in temperature are more offensive than constant extremes.

T F 6. The physiological effects of high temperatures probably interfere with efficiency more than the psychological effects.

T F 7. Fan capacity should be related to the nature of the industrial process.

T F 8. Ideal working conditions would involve a complete absence of noise.

T F 9. After long exposure to a noisy shop environment, the worker no longer finds it necessary to make a daily adjustment to it.

T F 10. Sustained noise of high intensity is more disturbing than a fluctuating noise.

T F 11. High-frequency noises are the principal industrial hazard because they are more difficult to control than noises of low frequency.

T F 12. In enclosed spaces, noise spreads more evenly than in the open.

T F 13. Music during work may be as distracting as continuous machine noises.

T F 14. Within certain limits, lengthening musical programs tends to result in more beneficial effects.

T F 15. Lengthening the work week has been chiefly responsible for increased production in war plants.

T F 16. Reducing hours of work will necessite the acceptance of a lower weekly wage on the part of postwar labor.

T F 17. When extra shifts are required, usual procedure is to assign to it as a nucleus skilled workers from the regular shift.

T F 18. Industrial experience has clearly indicated the desirability of rotating shifts.

T F 19. The chief problem of supervision in multiple-shift operation is one of coordination.

T F 20. Objections to unpopular shifts have been overcome in part by wage differentials.

T F 21. Proper illumination tends to prolong the productive period of employees.

T F 22. Mechanical devices to control ventilation and illumination are more dependable than natural means.

T F 23. With proper ventilation, airborne infections can be adequately controlled.

T F 24. Noise almost always results in lowered output.

T F 25. Vibrations which are not audible do not interfere with efficiency.

Name . .....

Grade . .....

CHAPTER V

APPLICATIONS

Set up an experiment to determine the effect of noise on the efficiency of operation in a general office employing 250 employees, 60 percent of whom are women. Describe in detail:

a. the method of selecting the experimental group;
b. how you would obtain a valid control;
c. the experimental setup;
d. the measures of efficiency you propose to use;
e. the method of evaluating the results obtained.

Chapter VI

THE WORKERS' HEALTH

Nutrition

References specifically dealing with nutritional problems in industry include:

The food and nutrition of industrial workers in war time (Washington: National Research Council, Committee on Nutrition in Industry, 1942).

Food, work, and war (New York: National Association of Manufacturers, 1943).

Nutrition in industry (Evansville: Servel, Inc.).

Suitable provisions for cafeteria, lunchroom, snack bar, canteen, and lunchroom service may be made with the advice of the manufacturers of such equipment. Many of these have available illustrated booklets on this subject; see, for instance, those published by Albert Pick Co., Inc., of Chicago.

Recreation

The *need* for recreation and methods for providing facilities and organizing programs are discussed in:

Duggins, G. H., and F. R. Eastwood: *Planning industrial recreation* (Lafayette: Purdue University, 1941).

Recreation in war time (Publication #3624. Washington: Office of Civilian Defense, 1943).

Robinson, Mary V.: *Recreation and housing for women war workers* (Bulletin #190. Washington: United States Department of Labor, Women's Bureau, 1942).

Complete information and suggestions on the *organization* of industrial recreational programs are available from the Industrial Recreation Association of Chicago. Purdue University maintains an Industrial Recreation Section in its Division of Physical Education for Men. An outline of the services available from these sources may be found in:

Determining recreational interests (Chicago: Industrial Recreation Association, 1943).

Company-sponsorship of *employee gardens* is promoted by the National Victory Garden Institute of New York, which publishes a manual containing full details. Several good motion pictures are available to stimulate interest and give needed information on employee gardens, and are released through such organizations as: Film Division, Agricultural Extension Service, United States Department of Agriculture; International Harvester Company; Better Homes and Gardens; and Aetna Life Insurance Company.

Medical Service

Several official and semi-official agencies have been active in sponsoring better medical services for industrial employees, and some companies have published information on the services which they have provided for their workers. Details of programs found effective appear in:

Health and the production front (New York: National Association of Manufacturers).

Health for your workers (Washington: Chamber of Commerce of the United States, Health Advisory Council).

Industrial health practices (New York: National Association of Manufacturers).

Medical service for workers in smaller plants (Washington: Chamber of Commerce of the United States, Health Advisory Council).

Medical supervision and service in industry (New York: National Industrial Conference Board).

Outline of an industrial hygience program (Washington: United States Public Health Service, 1943).

Physical examination in industry (New York: Metropolitan Life Insurance Company).

Sappington, C. O.: *Essentials of industrial health* (Philadelphia: J. B. Lippincott Co., 1943).

Sappington, C. O.: *Industrial health—asset or liability* (Chicago: Van Hoesen, 1940).

The United States Public Health Service also has available a series of motion pictures designed to educate employees in the prevention and cure of sickness and thus to curtail absenteeism.

Women Workers

The Women's Bureau of the United States Department of Labor publishes pamphlets dealing with many phases of the problem of women employees. It has a bi-monthly magazine, *The Woman Worker,* which prints up-to-date information on this subject. Several aspects are touched on in:

Trembly, Alfred G.: *The distinct problem of women employees* (Chicago: Van Hoesen, 1940).

Excellent educational material on *menstruation* is available from the following manufacturers:

International Cellucotton Products Company, Chicago: *Every minute counts, That day is here again,* and a wall chart for the women's restroom on menstrual physiology.

Tampax, Inc., Palmer, Mass.: Folders of education material, wall charts, and pamphlet: *Menstruation, its purpose, function, and care.*

Information on *planned parenthood* may be obtained from the Planned Parenthood Federation of America, Inc., New York, and from such commercial companies as Durex Products, Inc., and Holland-Rantos Company, both of New York, which have prepared complete plant programs.

Industrial Fatigue

The chief problems in industrial fatigue are discussed in:

Fatigue of workers—its relation to industrial production (New York: National Research Council, 1911).

Ramsey, J., R. E. Rawson, and others: *Restpauses and refreshments in industry* (London: National Institute of Industrial Psychology, 1939).

Sayers, R. R.: *Findings from major studies on fatigue* (Washington: Bureau of Mines, Information Circular 7209, 1942).

The *systematic study* of industrial processes by means of observations, analysis, exact measurement, and photographic recording has led to the simplification of operations and to the elimination of much unnecessary fatigue. Instruments are available for the graphic recording of processes, and many operations have been modified on the basis of such records with resulting reduction in cost and inefficiency. Methods for attaining these ends are discussed in detail in:

Esterline, J. W.: *Graphic routes to greater profits* (Indianapolis: The Esterline-Angus Company, Inc.)

Maynard, Harold B., and G. J. Stegemerten: *Operation analysis* (New York: McGraw-Hill Book Co., 1939).

The Graphic—a series of bulletins published by the Esterline-Angus Company, Inc., Indianapolis, each containing a case study of a specific application of graphic recording to improving industrial methods.

Mechanical contrivances to facilitate moving loads are now available in a wide variety of styles to suit individual needs. An idea of how much labor can be saved by mechanical means may be gained from examining such a pamphlet as:

Modern material handling machinery applied to American industry (Philadelphia: The Yale and Towne Manufacturing Company, 1943).

Name .....

Score ...

Questions on Chapter VI

T F 1. Responsibility for maintaining adequate food services usually is shared by the personnel and medical departments.

T F 2. An adequate lunch period should allow time for relaxation as well as for eating.

T F 3. The success of a balanced recreational program depends on the obligatory participation of all workers.

T F 4. It seems advisable for the personnel manager to assume full responsibility for the recreational program.

T F 5. There is a tendency for workers who avail themselves of an occasional sick leave to require fewer extended absences.

T F 6. The per capita cost of medical care increases in proportion to the number of employees served by it.

T F 7. Women are less adaptable than men to changes in temperature.

T F 8. If more adequate information were available to them, more women than at present would stay home during menstrual periods.

T F 9. Maternity information is designed particularly to help unmarried prospective mothers.

T F 10. Industrial fatigue is considered a peculiar condition existing in employed individuals.

T F 11. Reconversion of lactic acid into muscle fuel occurs principally during continued activity.

T F 12. Muscular fatigue tends to spread throughout the body.

T F 13. When performance deteriorates, there is evidence of physiological fatigue.

T F 14. Psychological fatigue is a synonym for disinterestedness.

T F 15. Excessive motivation may cause the worker to disregard physiological fatigue.

T F 16. Efficiency engineering attempts to replace each energy-consuming process by a mechanical operation.

T F 17. Experience has demonstrated that most workers perform better when standing at their benches rather than sitting down.

T F 18. In general, tools should be chosen to suit (a) the job to be done, and (b) the operator.

T F 19. Motivation counteracts psychological fatigue.

T F 20. The chief purpose of rest periods is to allow workers to recover from accumulated fatigue.

T F 21. Giving workers permission to rest when desired results in longer actual working time than when rest periods are planned.

T F 22. Rest periods should occur whenever the production curve assumes a downward trend.

T F 23. It is advisable to let workers plan their own activities during rest periods.

T F 24. Complete relaxation is the most effective kind of rest in industry.

T F 25. The effects on performance of the two kinds of fatigue are not distinguishable.

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Chapter VI

APPLICATIONS

1. The vice-president in charge of manufacturing for your company has asked you to determine the need for regular rest periods in the main plant. How do you propose to obtain this information for him and to make recommendation concerning (a) the time at which rest periods should occur; (b) the length of rest periods; (c) provisions for spending rest periods in the most effective manner; and (d) determining the effect of rest periods on production?

2. Write a memorandum to the president of the company in support of the union's demand for adequate medical services. Your company employs 350 workers, of whom 260 are women, and is located in a small city in which there are no large manufacturing concerns, but several small defense plants employing from 90 to 600 people. Stress particularly the following points: (a) general services included; (b) special services demanded by presence of considerable proportion of women workers; (c) advantages accruing to the company; (d) possible setup to provide adequate services at low cost.

Chapter VII

PROMOTING SAFETY

Industrial Accidents

General discussions of the causation, prevention, and cost of accidents are found in several books and articles published in recent years. The National Safety Council, through its bulletins and occasional publications, provides important statistical data on this subject. The following titles contain good introductory material:

Heinrich, H. W.: *Industrial accidents* (New York: McGraw-Hill Book Co., 1941).

Tiffin, Joseph: *Industrial psychology* (New York: Prentice Hall, 1943).

Viteles, M. S.: *Industrial psychology* (New York: W. W. Norton Co., 1932).

Accident Proneness

The factors involved in accident proneness have been studied by many investigators. Some of the results are given in:

American Engineering Council: *Safety and production* (New York: Harper and Bros., 1928).

Drake, C. A.: *Accident-proneness: a hypothesis* (*Character and Personality,* 1940: 8, 335-341).

Hersey, R. B.: *Emotional factors in accidents* (*Personnel Journal,* 1936: 15, 59-65).

Hersey, R. B.: *Rates of production and emotional state* (*Personnel Journal,* 1932: 10, 355-364).

Shrosbee, G.: *Relation of accident proneness to length of service* (*Industrial Welfare,* 1933: 7-8).

Slocombe, C. S.: *Consistency of operating efficiency* (*Personnel Journal,* 1929: 8, 138-145).

Vernon, H. M.: *An experience of munitions factories during the great war* (*Occupational Psychology,* 1940: 14, 1-14).

Accident Prevention

The organized movement for the reduction of frequency and severity of accidents in this country has been furthered by the National Safety Council whose numerous publications are a rich source of information on methods and results (see its annual *Accident Facts*). Through the competitions which the Council sponsors annually, strong impetus is given to the drive to make the workers themselves more interested in maintaining no-accident records.

The Industrial Health Research Board of Great Britain pioneered in the technique of identifying accident-prone workers by means of testing. In this country, Morris S. Viteles was among the first to apply selective methods to the solution of the problem of accident prevention in his work with various transportation companies.

Information on methods of diagnosis and prevention is available from such sources as these:

The accident-prone employee (New York: Metropolitan Life Insurance Company, 1930).

Safe transportation (New York: Personnel Research Federation, 1930).

Preventing taxicab accidents (New York: Metropolitan Life Insurance Company, 1931).

The idea of *painting* machinery and different parts of the work space with distinctive colors has received much attention in late years. In addition to promoting safe operation, proper color schemes have been found effective in counteracting industrial fatigue by balancing hues as well as regulating intensities of reflected light from various surfaces in the visual space. Details of color planning may be found in:

Birren, Faber: *Color in the plant* (*Factory Management and Maintenance,* 1945: 103, 2).

Color power for industry (Cleveland: Arco Company, 1944).

Planned color for plant savings (*Modern Industry,* 1945: 10, 1, 33-39).

The optonic color system (Cleveland: Arco Company, 1944).

An excellent idea of the variety of *safety equipment* now available may be gained from examining the catalogue of safety equipment of the American Optical Company and its separate pamphlets describing such items as goggles, helmets, respirators, safety clothing, protective gloves, leggings, spats, etc. The International Shoe Company, through its Hy-Test Division, publishes two booklets (St. Louis, 1945) containing important data in connection with adequate foot protection: *Let's use our heads and save our feet,* and *The whole story.*

The promotion of *safety programs* through publicity has been aided by the periodic publication of striking posters by several companies manufacturing safety equipment, such as the American Optical Company, Southbridge, Mass., and International Shoe Company, Hy-Test Division, St. Louis. In addition to providing elaborate statistical analyses of accident rates, causes, and types, the National Safety Council has available valuable information on the organization of effective safety programs.

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Questions on Chapter VII

T F 1. An accident involving a machine that is part of a chain of production involves to some extent earlier as well as later operations.

T F 2. The causation of an accident lies in a certain combination of contributory conditions and characteristics of the worker.

T F 3. Mechanical hazards alone never are responsible for accidents.

T F 4. Undesirable working conditions may, through their effect on the worker's judgment and coordination, be directly responsible for an accident.

T F 5. The likelihood of a worker being involved in an accident after he has just survived one is less than that of a man who has not had an accident for six months.

T F 6. A depressed person is more accident-prone than a well-adjusted man.

T F 7. Safe operation requires a specific minimum degree of general capacity for each type of job, depending on the degree of hazard involved.

T F 8. Statistics show that older workers are more likely to have accidents than younger men.

T F 9. It is a safe assumption that an applicant who possesses characteristics conducive to accidents is an undesirable employment risk on any kind of job in the plant.

T F 10. Each new worker, regardless of his previous experience, should be trained in safe methods of operation.

T F 11. Safety devices make training in safe operation superfluous.

T F 12. The chief problem in making available safety equipment is to get workers to use it regularly.

T F 13. To be effective, instructions on safety should be specific rather than general.

T F 14. Individual competition has been found more effective than group competition in promoting safety.

T F 15. Accidents tend to affect adversely the morale of workers who are not themselves involved.

T F 16. Most industries allow a fixed amount in their budget for accident costs.

T F 17. Contributory causes of accidents are more easily controlled than immediate factors.

T F 18. Prohibitions against the employment of women on certain jobs proves that some kinds of work are inherently hazardous.

T F 19. Accidents brought about by temporary emotional upsets do not happen to men with stable personalities.

T F 20. A chief problem in industry is the prevalence of workers unable to learn to avoid common dangers.

T F 21. Sensory acuity, in many cases, prevents accidents by recognizing preliminary warning signals.

T F 22. Experienced workers may become more accident-prone because they have become oblivious to the potential dangers of their jobs.

T F 23. Men whose hands are faster than their eyes are not likely to become involved in an accident.

T F 24. Most companies organize safety huddles at irregular intervals, usually after an accident has occurred.

T F 25. The principal purpose of safety devices is to protect workers who intentionally disregard safety rules.

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Chapter VII

APPLICATIONS

1. Explain why in some plants the number of accidents decreases steadily with increasing age of workers, while in others the opposite is true.

2. Why do some departments in a plant have few first-aid accidents but many lost-time accidents?

3. Name some of the characteristics of applicants which could be measured as part of the selection procedure in a company wishing to hire accident-free workers.

4. What specific training method would you recommend to reduce an excessive accident rate?

5. In what specific ways can the Labor-Management Production Committee assist in making workers more safety-conscious?

Chapter VIII

SUPERVISION

The Foreman

There are several good books available in which the characteristics of good supervision and the peculiar problems of foremanship are discussed. Among the more recent publications are these:

Cooper, Alfred M.: *How to supervise people* (New York: McGraw-Hill Book Co., 1941).

The foreman's role in cost reduction (Production Series #123. New York: American Management Association, 1940).

Gardiner, Glenn: *How to handle grievances* (New York: Elliott Service Company, 1937).

Grievance procedures (Princeton University Industrial Relations Section, 1941).

Increasing factory output through better production control (Production Series #129. New York: American Management Association, 1941).

Kress, A. L.: *Foremanship fundamentals* (New York: McGraw-Hill Book Co., 1942).

Lapp, John A.: *How to handle labor grievances* (Deep River: National Foreman's Institute).

Maynard, Harold B. (Ed.): *Effective foremanship* (New York: McGraw-Hill Book Co., 1941).

Production control clinic (Production Series #137. New York: American Management Association, 1942).

Selecting Supervisors

The Industrial Relations Section of the California Institute of Technology published in 1943 a series of booklets particularly useful in this field. They take up individually the important phases of an adequate selection procedure, as follows:

Describing the supervisor's job (#8).

Selection of supervisors (#9).

Selecting, training, and rating supervisors (#6).

Using descriptions of supervisory jobs (#7).

Other publications in this field are:

Bingham, Walter V.: *Administrative ability, its discovery and development* (Washington: Society for Personnel Administration, 1939).

Cleeton, Glen U., and Charles W. Mason: *Executive ability, its discovery and development* (Yellow Springs: Antioch Press, 1934).

Oberdahn, R. C.: *How to select foremen and supervisors* (Deep River: National Foreman's Institute).

Riegel, John W.: *The selection and development of prospective foremen* (Ann Arbor: University of Michigan Press, 1941).

Selection and development of foremen and workers (New York: American Management Association, 1940).

Training Supervisors

The problem of training supervisors has seemed so important to the federal government that it has made available, through the Training Within Industry Division of

the War Manpower Commission a series of pamphlets containing case histories of training at the supervisory level found satisfactory in industrial situations. Although each of these was developed in a specific situation and adapted to its peculiar needs, many suggestions may be found in these examples for application elsewhere. In addition, the following titles may be helpful:

Beckman, R. O.: *How to train supervisors* (New York: Harper and Bros., 1940).

Cleeton, Glen U., and Charles W. Mason: *Executive ability, its discovery and development* (Yellow Springs: Antioch Press, 1934).

Cushman, Frank: *Foremanship and supervision* (New York: John Wiley and Sons, 1938).

The development of foremen in management (Research Report #7. New York: American Management Association, 1945).

The foreman's letter (Bi-weekly. Deep River: National Foreman's Institute).

Gardiner, Glenn: *Better foremanship* (New York: McGraw-Hill Book Co., 1941).

Starr, Richard B. (Ed.): *Foremanship training* (New York: Prentice-Hall, 1943).

Training of supervisors (Bulletin #10. Pasadena: California Institute of Technology, Industrial Relations Section, 1943).

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Questions on Chapter VIII

T F 1. Most skilled workers are able to assume the responsibilities of supervision without special training.

T F 2. The foreman should refer all men with wage problems to the payroll division.

T F 3. Refusal to handle an assigned task is justifiable ground for immediate disciplinary action.

T F 4. Whenever possible, complaints should be adjusted on the level where they originate.

T F 5. The foreman's decision on a grievance should be final.

T F 6. Most men prefer putting their complaints in writing.

T F 7. An obstacle to adequate supervisory selection is the lack of valid descriptions of the foreman's job.

T F 8. Preliminary selection of supervisors frequently is made on the basis of try-outs and other forms of experimentation.

T F 9. Labor and management are agreed that union leadership indicates suitability for supervision.

T F 10. It is definitely known that the worker's educational background is an indication of supervisory capacity.

T F 11. Ratings are of questionable value in supervisory selection because they reflect the subjective impression of the rater.

T F 12. Adequate tests for supervisory selection await the completion of detailed job specifications.

T F 13. Formal training courses for prospective foremen have been found to be satisfactory substitutes for tryout experiences.

T F 14. The chief purpose of pre-supervisory training courses is to broaden the workers' education.

T F 15. Specific job skills are stressed in pre-foremanship training courses.

T F 16. Most pre-foremanship training programs include a variety of subjects and types of experience.

T F 17. The purpose of the instructional technique is to give foremen information on company policies.

T F 18. Improved methods of record-keeping can be taught best by the informational method.

T F 19. To be fully effective, the foreman conference should include only men of equal rank and similar experience.

T F 20. As a general rule, line officers make the best conference leaders.

T F 21. It is essential to keep foremen fully informed of every change in company policies affecting the workers.

T F 22. Generally, the foreman is expected to accept without question the judgment of the plant's efficiency expert in the matter of modifying operations in his department.

T F 23. The foreman should assume his responsibilities fully and without attempting to delegate some of them to others.

T F 24. Part of the supervisor's job is to build the highest possible quality into the company's product.

T F 25. Industrial experience shows that foremen grow on their jobs, after a certain amount of experience, without needing further training.

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CHAPTER VIII

APPLICATIONS

Outline a supervisory selection program for a large plant, stating concisely:

a. the characteristics of workers which you would consider as evidence of promotability;

b. the selective devices which you propose to use;

c. the training facilities which you would provide for foreman candidates;

d. the basis on which your final decision concerning promotion to a supervisory job will be based;

e. the technique whereby you will follow up your selections.

Chapter IX

MERIT RATING

The Purpose of Merit Rating

Merit rating has become a part of the standard procedure in so many companies that a considerable amount of information is available on the purposes for which it has been found useful. Its basic principles are set forth in such publications as these:

Employee rating: methods of appraising ability, efficiency, and potentialities (Studies in Personnel Policy #39. New York: National Industrial Conference Board, 1942).

Hay, Edward N.: *Selling a rating plan* (*Personnel Journal,* 1941: 18, 1, 42-48).

Knowles, A. S.: *Merit rating in industry* (Boston: Northeastern University, 1940).

Poffenberger, A. T.: *Principles of applied psychology.* Chapter 14. (New York: D. Appleton-Century Co., 1942).

Tiffin, Joseph: *Industrial psychology.* Chapter 9. (New York: Prentice-Hall, 1943).

Walters, J. E.: *Rating the job and the man* (*Factory Management and Maintenance,* 1937: 95, 6).

Forms of Rating Scales

The effectiveness of a rating scale depends to a large measure on the care with which it has been constructed.

Although in each situation the requirements are likely to be different, much can be gained from the experience of others in this respect. The following are titles which discuss the details of construction found workable in practical situations:

Employee rating methods (New York: Metropolitan Life Insurance Company).

Guilford, J. P.: *Psychometric methods.* Chapter 9. (New York, McGraw-Hill Book Co., 1936).

Plans for rating employees (New York: National Industrial Conference Board, 1938).

Remmers, H. H., and N. L. Gage: *Educational measurement and evaluation.* Chapter IX. (New York: Harper and Bros., 1943).

Starr, R. B., and R. J. Greenly: *Merit rating survey findings* (*Personnel Journal,* 1939: 17, 378-384).

Steinmetz, H. C.: *Manual of industrial efficiency rating* (Los Angeles: Harwood Company, 1943).

Symonds, P. M.:*Diagnosing personality and conduct.* Chapter III. (New York: The Century Company, 1931).

Evaluating the Results

Many books on statistical procedure offer methods for evaluating the results of merit rating, though some of these are too complex to be used by persons without statistical training. The following references have particular bearing on certain of the practical aspects of proper evaluation.

Allport, Gordon W.: *Personality, a psychological interpretation.* Chapter 16. (New York: Henry Holt and Co., 1937).

Bingham, Walter V.: *Halo, invalid and valid* (*Journal of Applied Psychology,* 1939: 23, 221-228).

Driver, R. S.: *A case history in merit rating* (*Personnel,* 1940: 16, 4, 137-162).

Ewart, Edwin, S. E. Seashore, and Joseph Tiffin: *A factor analysis of an industrial merit rating scale* (*Journal of Applied Psychology,* 1941: 25, 481-486).

Richardson, M. W., and G. F. Kuder: *Making a rating scale that measures* (*Personnel Journal,* 1933: 12, 36-40).

Stevens, S. N., and E. F. Wonderlic: *An effective revision of the rating technique* (*Personnel Journal,* 1934: 13, 125-134).

Tiffin, Joseph, and W. Musser: *Weighting merit rating items* (*Journal of Applied Psychology,* 1942: 26).

Practical Values

There are many instances in the literature of successful practical applications of the rating-scale technique. Among these, the following may be of interest:

Benge, E. J.: *Job evaluation and merit rating* (Deep River: National Foremen's Institute, 1941)

Horst, Paul, *et al.*: *Prediction of personal adjustment* (Bulletin #48. New York: Social Science Research Council, 1941).

Humke, Homer L.: *Full use of employee ratings* (*Personnel Journal,* 1939: 16, 292-295).

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Questions on Chapter IX

T F 1. For purposes of horizontal upgrading, rating scales have not been found useful.

T F 2. The workers' morale tends to be adversely affected if they are acquainted with the traits on which they are rated by their foremen.

T F 3. The foreman is in an excellent position to discuss his own ratings with his men.

T F 4. Many companies have found that improved supervision resulted from the use of rating scales.

T F 5. Supervisors' ratings of their own men have served to help management detect poor supervisors.

T F 6. A good rating scale should include such traits as estimated intelligence, mechanical aptitude, and the like.

T F 7. In most rating scales, "honesty" is a valid trait.

T F 8. Experience has shown that eight gradations of a trait can be distinguished by most raters.

T F 9. Gradations should be labeled with behavioral rather than general terms.

T F 10. Combined ratings are significant only if the raters agree on rating standards.

T F 11. Numerical values for each trait should be printed on the rating scale.

T F 12. Gradations for each trait should be evaluated on a scale from -10 to $+10$.

T F 13. Ratings tend to weight themselves due to differences in their variabilities.

T F 14. It is good practice to have the superintendent go over the foreman's ratings before they are evaluated.

T F 15. Merit ratings may be used to increase compensation within the established range.

T F 16. The employment office may use merit ratings as a check on the effectiveness of its placements.

T F 17. The "probable error" is a statistical safeguard against errors of judgment.

T F 18. The halo effect can be counteracted by keeping constant the polarity of traits on the rating scale.

T F 19. With different raters, unreliability can be controlled better than if the same raters are used again.

T F 20. Pooling ratings may decrease the validity of a valid individual rating.

T F 21. The value attached to a trait on the scale should correspond to its value in the job evaluation.

T F 22. Ratings are likely to be more significant if the foreman is required to discuss them with his men.

T F 23. If the "type" theory were correct, only two gradations of traits would be required.

T F 24. "Speed" and "quantity of output" are mutually exclusive rating items.

T F 25. Ratings supplement records rather than supplant them.

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CHAPTER IX

APPLICATIONS

1. A plant wishes to establish a basis for supervisory selection by taking advantage of all available records, test results, and merit ratings. Indicate for each of the following characteristics how pertinent information can be obtained best:

Intelligence	Previous experience . .
Punctuality	Capacity for leadership
Sociability	Appearance . . . . .
Mechanical aptitude	Productive capacity .
Age	Attitude toward company . . . . .
Health	Schooling . . . .

2. What are the chief practical uses of merit rating?

3. On what basis should the various traits on a merit-rating scale be weighted?

4. On what basis should the gradations on various rating-scale items be weighted?

5. Outline the steps necessary to set up a rating program and to put it into effective operation. State particularly how you would go about securing the cooperation of all persons concerned and what you would do to make the program maximally effective.

Chapter X

PROVIDING INCENTIVES

Employee Morale

Studies of employee attitudes tend to show conclusively that the level of morale in an organization is dependent on the degree to which the workers' needs for security and recognition are satisfied. Among such studies are the following:

Bergen, H. B.: *Finding out what employees are thinking* (New York: National Industrial Conference Board, *Management Record,* April 1939).

Bergen, H. B., C. E. Haines, L. G. Giberson, F. L. Hallock, and C. S. Coler: *Attitudes and emotional problems of office employees* (Office Management Series #87. New York: American Management Association).

Collier, H. E.: *The mental manifestations of some industrial illnesses* (*Occupational Psychology,* 1939: 13, 89-97).

Fisher, V. E., and J. V. Hanna: *The dissatisfied worker* (New York: The Macmillian Co., 1931).

Hall, P., and H. W. Locke: *Incentives and contentment* (London: Sir Isaac Pitman and Sons, Ltd., 1938).

Hersey, L. B.: *The psychology of workers* (*Personnel Journal,* 1936: 14, 291-296).

Hoppock, L.: *Job satisfaction* (New York: Harper and Bros., 1935).

Houser, J. D.: *What people want from business* (New York: McGraw-Hill Book Co., 1938).

Kolstad, A.: *Employee attitudes in a department store* (*Journal of Applied Psychology,* 1938: 22, 470-479).

Pratt, George K.: *Morale: the mental hygiene of unemployment* (New York: National Committee for Mental Hygiene, 1933).

Super, E. D.: *Occupational level and job satisfaction* (*Journal of Applied Psychology,* 1939: 23, 547-564).

Thurstone, L. L., and E. J. Chase: *The measurement of attitude* (Chicago: University of Chicago Press, 1929).

Uhrbrock, R. S.: *Attitudes of 4430 employees* (*Journal of Social Psychology,* 1934: 5, 365-377).

Williams, W.: *Mainsprings of men* (New York: Charles Scribner's Sons, 1925).

Williams, W.: *What's on the worker's mind* (New York: Charles Scribner's Sons, 1920).

Industrial Incentives

The general concept of *labor-management cooperation* to further industrial effectiveness is brought out in such titles as these:

Golden, Clinton S., and Harold J. Ruttenberg: *The dynamics of industrial democracy* (New York: Harper and Bros., 1942).

Knickerbocker, Irving, and Douglas McGregor: *Union-management cooperation, a psychological analysis* (Cambridge: Massachusetts Institute of Technology, 1942).

Labor and management in a democracy (*Public Opinion Quarterly,* Fall, 1943. Entire issue).

Producing for victory (New York: International Federation of Architects, Chemists, and Technicians—CIO, 1942).

The technique of supplying workers with *information* is taken up in the following:

Heron, Alexander R.: *Sharing information with employees* (Stanford University Press, 1942).

How to prepare and publish an employee manual (New York: American Management Association, 1942).

Methods of transmitting information to employees (Princeton University Industrial Relations Section, 1942).

From among the many publications designed to acquaint workers with *company policies* and status, the following are selected as representative samples:

Employee postwar readjustment plan (Cincinnati: Crosley Corporation. Special edition of *Crosley News and Views*).

Southern Bell Telephone News (Monthly. Atlanta: Southern Bell Telephone Company).

You and your job in General Motors (Detroit: General Motors Corporation, 1941).

The *Labor-Management Production Committee* has become a well-established aid to industrial effectiveness throughout the country. It has proved invaluable in many cases where fundamental policies affecting both labor and management had to be established or revised. For instance, the Mengel Company turned over to the Labor-Management Production Committee, consisting of eight workers' and eight management representatives, the problem of reconverting its assembly line in one of its plants into twenty separate assembly lines for postwar production. This was achieved with a minimum loss of productive capacity and

a minimum of labor turnover and retraining. Information on the organization of such committees is available from the War Production Drive Division of the War Production Board. It makes available to a limited group confidential reports on effectively organized and operated committees in individual companies, which offer many suggestions for application elsewhere. In addition, it publishes a regular paper, *Labor and Management News,* from which reprints also are available. The following are of particular interest:

Check your program (Report #7, May 27, 1944).

Good food (Report #8, May 27, 1944).

How to establish and operate a Labor-Management Production Committee (Supplement #4. Vol. II, #29, June 3, 1944).

Turnover (Report #5, May 20, 1944).

Another good source of information is:

Development and operation of a joint Management-Labor Committee (Production Series #136. New York: American Management Association, 1942).

The giving of *individual recognition* may take the form of awarding service buttons to long-time employees. It was found in a national survey of employers of over 2,000,000 workers that this resulted in (1) a closer feeling between workers and management, (2) increased worker interest in the job, (3) fewer labor troubles, (4) more constructive employee thinking, and (5) decreased absenteeism. Further details on this type of recognition and its effectiveness are found in:

Employee service award systems (Attleboro: The Robbins Co., 1944).

The following publications of the Policyholders Service Bureau, Metropolitan Life Insurance Company, New York,

deal with different aspects of *employee participation* in ownership of the company:

Employee stock ownership

Sharing profits with employees

Stock ownership plans for key employees

There is, of course, a considerable amount of published material dealing with *union recognition* and *collective bargaining*. Much of this is strongly biased in one direction or another, but the following titles have been selected as presenting the problem in a reasonably factual manner:

Bundy, R. D.: *Collective bargaining* (Deep River: National Foremen's Institute, 1942).

The collective bargaining agreement in action (Personnel Series #82. New York: American Management Association, 1944).

Hill, Lee H., and Charles R. Hook, Jr.: *Management at the bargaining table* (New York: McGraw-Hill Book Co., 1945).

Management's stake in collective bargaining (Personnel Series #81. New York: American Management Association, 1944).

Nunn, H. L.: *Do workers really get a square deal?* (Forbes: April 15, 1936).

Pierson, Frank C.: *Collective bargaining systems* (Washington: American Council on Public Affairs, 1942).

Practical techniques of collective bargaining (Personnel Series # 86. New York: American Management Association, 1944).

Methods for making *suggestion plans* effective are discussed in:

Employee suggestion systems (Studies in Personnel Policy #43. New York: National Industrial Conference Board, 1942).

Individual awards plan—honors for production ideas (Washington: War Production Board, War Production Drive, 1943).

Morton suggestion system (Chicago: Morton Manufacturing Company).

Suggestion guide for Labor-Management Committees (Washington: War Production Board, War Production Drive, 1943).

Suggestion systems (New York: Metropolitan Life Insurance Company, Policyholders Service Bureau, 1942).

Suggestion systems—tool in war and peace (*Modern Industry*, 1945: 9, 4, 40-44).

The War Production Drive and suggestion system techniques (Production Series #142. New York: American Management Association, 1942).

Details of an *insurance* plan maintained by a large company are available in two publications of the General Motors Corporation: *Employee group insurance plan,* and *General Motors employees contributory retirement plan* (1941).

An excellent summary of the wide variety of *pension* plans in effect at a recent date is found in:

Pension plans—good, bad, and legal (*Modern Industry,* 1944: 7, 6, 48-60).

The feasibility of *annual wages* is discussed in the following titles:

Leather products business (Case #12, Employment Stabilization Service. Minneapolis: Minnesota American Legion Foundation, 1940).

Nunn-Bush annual wage plan is real success (*Milwaukee Journal,* February 8, 1942).

Year-round jobs pay both this boss and his men (*Modern Industry*, 1945: 10, 1, 64-76).

Incentive pay, in one form or other, has been widely accepted as a satisfactory arrangement to labor and management alike. Several of the problems involved in arriving at acceptable rates of payment are outlined in such publications as:

Dickinson, Z. Clark: *Compensating industrial effort* (New York: Ronald Press, 1937).

Hopwood, J. O.: *Salaries, wages, and labor relations* (New York: Ronald Press, 1937).

100% bonus is paid by "selfish" factory (*Milwaukee Journal,* January 24, 1943).

Kennedy, Van Duren: *Union policy and incentive wage methods* (New York: Columbia University Press, 1945).

Louden, J. K.: *Wage incentives* (New York: John Wiley and Sons, 1944).

Practical uses of wage incentives (Production Series #150. New York: American Management Association, 1944).

Riegel, John W.: *Paving the way for an incentive plan* (Pasadena: California Institute of Technology, 1943).

Riegel, John W.: *Wage determination* (University of Michigan Bureau of Industrial Relations, 1937).

Shepard, J. L.: *Recognition on the job* (*Personnel Journal,* 1937: 16, 111-119).

Smith, E. D.: *Wages as incentives* (in: *Handbook of Business Administration,* 1159-1168. New York: McGraw-Hill Book Co., 1931).

Uhrbrock, R. S.: *A psychologist looks at wage-incentive methods* (Institute of Management Series #15. New York: American Management Association, 1935).

That the promotion of *social life* for employees is not an expensive undertaking, but can be made profitable even for a small company, follows from:

Morale boosters, small-plant style (*Modern Industry,* 1944: 7, 6, 74-78).

A survey of experience in establishing and maintaining a *company magazine* is available in:

Employee magazines (New York: Metropolitan Life Insurance Company, Policyholders Service Bureau).

Most union contracts provide for regular *vacation* periods with pay, often for increased periods for workers with greater seniority. Some pertinent publications are:

Developments in company vacation plants (Studies in Personnel Policy #13. New York: National Industrial Conference Board, 1939).

Trends in company vacation policy (Studies in Personnel Policy #21. New York: National Industrial Conference Board, 1940).

Vacations for industrial workers (New York: Metropolitan Life Insurance Company, Policyholders Service Bureau).

Veysey, Victor V.: *Vacations with pay* (Bulletin #2. Pasadena: California Institute of Technology, 1940).

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Questions on Chapter X

T F 1. An essential aspect of incentives is that they must involve the satisfaction of the worker's personal needs.

T F 2. Great progress has been made in the direct measurement of morale.

T F 3. To the satisfied worker, supervision provides a welcome relief from final personal responsibility.

T F 4. Generally speaking, informed workers tend to be more interested in their work.

T F 5. There is urgent need for federal legislation establishing Labor-Management Production Committees in all industries.

T F 6. The Labor-Management Production Committee is in a particularly strategic position to deal with wages and hours problems.

T F 7. The basic purpose of unionism is to increase wages.

T F 8. Experience has shown that most workers prefer signing their suggestions.

T F 9. The annual wage plan tends to add a considerable amount to the company's payroll.

T F 10. The annual wage plan necessitates cooperation on the part of dealers and distributors.

T F 11. Social security legislation contains adequate provisions for sickness insurance.

T F 12. Production charts may be based on individual output.

T F 13. Incentive pay appeals to the worker's need for security.

T F 14. Basically, incentive pay is a method for speeding output.

T F 15. An effective system of incentive pay provides for changeable standards of output.

T F 16. Basic hourly rates cannot be maintained under an incentive plan.

T F 17. Incentives payable to the entire plant are more effective than those applied to individuals or small groups.

T F 18. Promoting social life among employees tends to have a favorable effect on in-plant morale.

T F 19. The editorial policy of the company magazine should be set by management.

T F 20. The shut-down vacation plan can be combined easily with the annual wage plan.

T F 21. Exit interviews are more likely to be reliable than in-service interviews.

T F 22. Periodic interviews by line officers serve as an excellent means of determining morale.

T F 23. The basic purpose of an incentive is to relate industrially desirable behavior with the satisfaction of the workers' own needs.

T F 24. Incentives are necessary for rank-and-file workers, but not for supervisors and executives.

T F 25. Dealing with workers individually is simpler for the supervisor than dealing with a union representative.

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CHAPTER X

APPLICATIONS

1. List by appropriate sub-committees the principal functions to be assigned to a Labor-Management Production Committee in a steel plant located two miles outside a city of 250,000 population. There are 3,000 factory employees, all members of a CIO union, and the plant has the usual employee facilities such as: cafeterias, first-aid hospital, etc.

2. What steps would you take to put into effect an incentive pay system in a plant which heretofore has operated on a straight time basis?

Chapter XI

OCCUPATIONAL ADJUSTMENT

Indications of Occupational Maladjustment

Unbiased, factual statements of such symptoms of occupational maladjustment as strikes, absenteeism, and excessive turnover are not easily available, but the following are among the best examples of efforts in that direction:

Fox, John B., and Jerome S. Scott: *Absenteeism, management's problem* (Boston: Harvard University Business Research Studies #29, 1943).

Harbison, Frederick H.: *Seniority problems during demobilization and reconversion* (Princeton University Industrial Relations Section, 1944).

Why war workers strike (*Modern Industry*, 1945: 9, 3, 47-56).

Types of Personality Maladjustment

There are many excellent books available to students with a background of psychological training to aid in the recognition of symptoms of personality maladjustment. Among these, the most generally informative and least technical include:

Shaffer, L. F.: *The psychology of adjustment* (Boston: Houghton-Mifflin Co., 1936).

Wallin, J. E. Wallace: *Personality maladjustment and mental hygiene* (New York: McGraw-Hill Book Co., 1935).

The Prevention and Treatment of Occupational Maladjustment

The practical significance of proper occupational adjustment has been so obvious for so long that government agencies as well as industrial organizations have attempted for many years to find ways and means of preventing and treating symtoms of maladjustment. Some pertinent publications are:

Anderson, V. V.: *Psychiatry in industry* (New York: Harper and Bros., 1929).

Benge, Eugene J.: *Breaking the skilled labor bottleneck* (Deep River: National Foremen's Institute, 1942).

Controlling absenteeism (Special Bulletin #12. Washington: United States Department of Labor, Division of Labor Standards, 1943).

Dickson, W. J.: *Employee educational and counseling programs* (in: *Understanding and training employees.* Personnel Series #35. New York: American Management Association, 1938).

Employee counseling (Princeton University Industrial Relations Section, 1944).

The employee counselor in industry (New York: Metropolitan Life Insurance Company, Policyholders Service Bureau, 1943).

Exit interviews: an aid in the control of personnel turnover (Washington: War Department, Civilian Personnel Division, Employee Relations Branch, 1943).

Hibbs, Ray E.: *Absenteeism: Let's solve it the right way* (Minneapolis: North Star Woolen Mills Company, 1944).

Hibbs, Ray E.: *Labor turnover—it can be reduced by sound methods* (Minneapolis: North Star Woolen Mills Company, 1944).

Increasing factory output through better production control (Production Series #129. New York: American Management Association, 1941).

Introducing the new employee to the job (Bulletin #8. Washington: War Manpower Commission, Training Within Industry Division, 1942).

Maximum utilization of employed manpower (Princeton University Industrial Relations Section, 1943).

McGowan, Carolyn L.: *Counseling in industry* (*Social Service Review*, 1943: 135-137).

McPeak, C. F.: *Help workers to the right jobs* (*Personnel Journal*, 1943: 289-294).

Methods of controlling absenteeism (*Monthly Labor Review*, July 1943: 9-16).

More manpower through reduction of absences (Pittsburgh: Industrial Hygiene Foundation, 1942).

Orienting your new employee (Washington: War Department, Civilian Personnel Division, Employee Relations Branch, 1943).

Personnel counseling: key to greater production (Washington: Department, Civilian Personnel Division, Employee Relations Branch, 1943).

Problems of reemployment and retraining of manpower during the transition from war to peace—A bibliography. (Princeton University Industrial Relations Section, 1945).

Production control clinic (Production Series #137. New York: American Management Association, 1942).

Reducing absenteeism (Production Series #141. New York: American Management Association, 1942).

Reducing absenteeism (Studies in Personnel Policy #46. New York: National Industrial Conference Board, 1942).

Report, Committee on employee counseling in the United States Civil Service Commission (Departmental Circular #356. Washington: United States Civil Service Commission, 1942).

Roethlisberger, F. J.: *Management and morale* (Cambridge: Harvard University Press, 1941).

Soldiers to workers—human reconversion (*Modern Industry,* 1945: 10, 1, 43-47).

Tead, Ordway: *Employee counseling* (*Advanced Management,* 1943: 97-103).

Ways of dealing with absenteeism (Washington: War Production Board, War Production Drive, 1943).

Name . . . . . .

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Questions on Chapter XI

T F 1. The peculiar disadvantage of maladjustment lies more in the lack of personal satisfaction obtained than in inability to achieve results.

T F 2. Some form of occupational maladjustment is behind every strike.

T F 3. The basic reason why men change jobs is to increase their pay.

T F 4. The worker who manifests maladjustment by expressing his dissatisfaction does so regardless of the existence of favorable working conditions.

T F 5. Occupational maladjustment simply is a form of general personality maladjustment.

T F 6. Job maladjustment may indicate faulty placement.

T F 7. Proper selection is an adequate safeguard against the occurrence of maladjustment among the workers.

T F 8. Ordinarily, a man can control the mechanisims whereby he attempts to adjust to his job.

T F 9. The symptoms of personality maladjustment and of specific job maladjustment are easily distinguishable.

T F 10. Defensive reactions tend to limit themselves to a certain area of activity.

T F 11. Escape reactions involve an admission of inadequacy.

T F 12. Compulsions usually are a method of shifting emphasis to non-essentials.

T F 13. Motor psychoneuroses are more generalized in their effects on behavior than is hysterical illness.

T F 14. Through compensation, the person tries to turn a liability into an asset.

T F 15. Proper job information is an aid to adjustment.

T F 16. The counseling system is an attempt to discover and adjust initial symptoms of maladjustment.

T F 17. Frequently, transfer to another type of job is the most adequate treatment of maladjustment.

T F 18. Absenteeism shows that workers are not interested in their work.

T F 19. Past industrial experience is an important factor in a man's adjustment to his job.

T F 20. Good industrial relations are the basis of adequate job adjustment.

T F 21. In compensation, the individual tries to blame someone else for his failure.

T F 22. The typical psychoneurotic is a poor employment risk on any kind of work.

T F 23. Rationalizing means substituting plausible reasons for the actual reasons for one's behavior.

T F 24. A person's reaction to criticism may well be a significant indication of his level and type of adjustment.

T F 25. The purpose of most types of unusual behavior is to protect the individual's self-esteem.

Name . . . . . .

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CHAPTER XI

APPLICATIONS

From your own experience and observation, give detailed examples of each of the following types of maladjustment, including causes as well as symptoms: (a) rationalizing, (b) phantasy, (c) compensation, (d) projection, (e) hysterical illness.